

A Thesis Submitted for the Degree of PhD at the University of Warwick

Permanent WRAP URL:

<http://wrap.warwick.ac.uk/152743>

Copyright and reuse:

This thesis is made available online and is protected by original copyright.

Please scroll down to view the document itself.

Please refer to the repository record for this item for information to help you to cite it.

Our policy information is available from the repository home page.

For more information, please contact the WRAP Team at: wrap@warwick.ac.uk

The Goal Doesn't Matter, But Having One Does:
Exploring the Links Between Character Strengths, The
Broaden and Build Hypothesis, and Cognitive Flexibility.

Luke Hodson

A thesis submitted in fulfilment of the requirements for the
degree

Doctor of Philosophy in Psychology

University of Warwick, Department of Psychology

TABLES AND FIGURES	10
ACKNOWLEDGMENTS.....	15
PUBLICATION DECLARATION.....	16
ABBREVIATIONS	17
THESIS OVERVIEW	18
CHAPTER 1: POSITIVE PSYCHOLOGY AND HOPE.....	19
POSITIVE PSYCHOLOGY: A BRIEF OVERVIEW.....	19
KEY CONCEPTS IN POSITIVE PSYCHOLOGY	21
<i>The Good, Pleasant, and Meaningful Life (Seligman, 2003)</i>	21
<i>Flow</i>	21
<i>The Broaden and Build Hypothesis</i>	22
CHARACTER STRENGTHS.....	24
<i>Measuring Character Strengths</i>	25
<i>Character Strength Research</i>	27
HOPE	29
<i>Hope Research</i>	31
Hope in the Workplace	31
Hope and Academic Achievement	31
Hope and Health	32
Hope and Wellbeing.....	33
Hope Research in Summary	33
<i>Improving Hope</i>	33
<i>Measuring Hope</i>	35
MOVING BEYOND THE RESEARCH	36
CHAPTER 2: FLEXIBLE THINKING- WHAT IS COGNITIVE FLEXIBILITY?.....	38
WHAT DO WE KNOW ABOUT CF?.....	38
THE NEUROSCIENCE OF CF	39
CONCEPTUAL ISSUES.....	40
WHAT ARE EXECUTIVE FUNCTIONS?	41
<i>Inhibitory Control</i>	43
<i>Working Memory (WM)</i>	44
<i>Task Switching</i>	47
Connecting the Core Functions	48
<i>Other Higher Order Cognitive Functions</i>	49
Executive Attention (EA)	49
Fluid Intelligence	50
Divergent Thinking	51
<i>Where Does This Leave Our Understanding Of CF: An Umbrella Term?</i>	52
A PRAGMATIC VIEW OF CF: BEHAVIOUR, MEASURES, AND APPLICATIONS	53
<i>Behaviour Associated with CF</i>	53
<i>Traditional Measures of CF</i>	54
Behavioural Tasks.....	55
CF Questionnaires	58
CF in 'The Real World'	59
WHAT DO WE KNOW ABOUT CF NOW?	61
OVERLAPPING PSYCHOLOGICAL THEORIES.....	62
CHAPTER 3: BRINGING HOPE AND COGNITIVE FLEXIBILITY TOGETHER: METHODOLOGICAL ISSUES FOR THIS THESIS	63

MIXED METHODS (MM) RESEARCH.....	63
<i>Why Use a MM Approach?</i>	64
<i>Types of MM Methodologies</i>	66
Convergent Designs.....	66
Explanatory Designs	67
Exploratory Designs.....	67
MM RESEARCH IN PRACTICE.....	68
METHODOLOGICAL CHOICES AND PARADIGMS	69
OVERVIEW OF EMPIRICAL WORK	71
<i>Focus on The Paradigms</i>	72
Navon Task (NT)	72
Task Overview	73
The Adaptive Choice Task (ACT)	74
Task Overview	75
The Alternative Uses Task (AUT)	76
Task Overview	77
Diary Studies	78
SUMMARY OF THESIS STRUCTURE FOR EMPIRICAL CHAPTERS (CHAPTERS 4- 9).....	79

CHAPTER 4: EXPLORING CHARACTER STRENGTHS AND COGNITIVE FLEXIBILITY.....80

CHARACTER STRENGTHS AS AN INTERVENTION.....	80
METHODOLOGICAL CONSIDERATIONS	81
<i>Card Sorting</i>	81
<i>Use of a Free-Response Questionnaire</i>	82
<i>Bayesian Analysis</i>	83
STUDY 1: CST AND NAVON TASK (NT)	84
<i>Method</i>	85
Participants	85
Measures and Stimuli.....	85
Card-sort Task (CST)	85
Navon Task.....	87
Free-Response Questionnaire	88
Design.....	89
Procedure.....	89
CST Procedure	89
NT Procedure	90
RESULTS.....	91
<i>Descriptive Statistics</i>	91
Card Sorting Task	91
NT Data	94
Reaction Time.....	94
Accuracy	94
<i>Inferential Statistics</i>	95
RT Data.....	95
Frequentist Analysis	95
Predictiveness of CST sorting Quadrants.....	97
Accuracy data	97
Frequentist Analysis	97
Predictiveness of CST sorting Quadrants.....	98
<i>Qualitative Data</i>	98
Connection Between the Tasks	99
Character Strengths Reflection	100
DISCUSSION	101
STUDY 2: CARD SORTING TASK, AND ADAPTIVE CHOICE TASK	102

<i>The Current Study: Research Questions and Predictions</i>	102
METHOD.....	103
<i>Participants</i>	103
<i>Measures and Stimuli</i>	103
Card-Sort Task and Free Response Questionnaire	103
Adaptive Choice Task (ACT; Irons & Leber, 2015).	104
<i>Design</i>	105
<i>Procedure</i>	106
RESULTS.....	107
<i>Descriptive Statistics</i>	107
Card Sorting Task	107
ACT Data.....	110
Reaction Time.....	110
Accuracy	110
Optimality.....	110
<i>Inferential Statistics</i>	112
RT Data.....	112
Frequentist Analysis	112
Predictiveness of CST Sorting Quadrants	112
Accuracy data	113
Frequentist Analysis	113
Predictiveness of CST sorting Quadrants.....	114
Optimality data	114
Frequentist Analysis	114
Predictiveness of CST Sorting Quadrants	115
<i>Qualitative Data</i>	115
ACT Strategies	115
Target Selection Strategy	116
Target Switching.....	117
Distractor Changes	117
Free Response Questionnaire	118
Connection Between the Tasks	118
Character Strengths Reflection	119
DISCUSSION.....	120
<i>Reviewing the CST</i>	121
STUDY 3: CST AND ALTERNATIVE USES TASK	122
<i>The current study: Research questions and predictions</i>	123
METHOD.....	123
<i>Participants</i>	123
<i>Measures and Stimuli</i>	124
Card-Sorting Task and Free Response Questionnaire	124
Alternative Uses Task (AUT; Guilford et al., 1978)	124
AUT Analysis	124
<i>Design</i>	125
<i>Procedure</i>	126
RESULTS.....	127
<i>Descriptive Statistics</i>	127
Card Sorting Task	127
AUT Data	129
Fluency	129
Flexibility	129
Elaboration.....	129
Originality	129
Error Rate	129
<i>Inferential Statistics</i>	132
Fluency	132

Frequentist Analysis	132
Predictiveness Of CST Sorting Quadrants	132
Flexibility	133
Frequentist Analysis	133
Predictiveness Of CST Sorting Quadrants	133
Elaboration.....	134
Frequentist Analysis	134
Predictiveness Of CST Sorting Quadrants	134
Originality	135
Frequentist Analysis	135
Predictiveness Of CST Sorting Quadrants	135
Accuracy	135
Frequentist Analysis	135
Predictiveness Of CST Sorting Quadrants	136
<i>Qualitative Data</i>	137
Connection Between the Tasks	137
Character Strengths Reflection	138
DISCUSSION	139
<i>CST: Reviewing the Evidence</i>	140

CHAPTER 5: EXPLORING A GOAL-ORIENTED INTERVENTION AND COGNITIVE FLEXIBILITY IN A NAVON TASK142

LEARNING FROM THE CST	142
METHODOLOGICAL CHANGES.....	143
<i>Explicit vs Implicit Goal-Orientation</i>	143
<i>Targeted intervention- The Goal Reflection Task (GRT)</i>	144
<i>Revision of the Questionnaire Battery</i>	144
<i>Adapting the Free Response Questionnaire</i>	144
THE CURRENT STUDY: RESEARCH QUESTIONS AND PREDICTIONS	145
METHOD.....	146
<i>Participants</i>	146
<i>Measures and Stimuli</i>	146
Goal Reflection Task (GRT)	146
Navon Task.....	147
Questionnaire Battery	147
State Hope Scale (SHS)	147
Trait Hope Scale	147
Positive and Negative Affect Schedule (PANAS).....	148
Free-Response Questionnaire	148
<i>Design</i>	148
<i>Procedure</i>	149
GRT Procedure	150
NT Procedure	150
RESULTS.....	151
<i>Reflective Tasks</i>	152
Descriptive Statistics	152
Inferential Statistics.....	152
<i>Questionnaire Data</i>	152
Descriptive Statistics	152
Inferential Statistics.....	154
Difference Between Questionnaire Score at T1 And T2	154
GRT Relationship with Questionnaire Variables.....	157
<i>NT Data</i>	159
RT Descriptive Statistics	159
RT Frequentist Analysis	160
Predictiveness of GRT.....	161

Predictiveness of Questionnaires	161
Accuracy Descriptive Statistics	164
Accuracy Frequentist Analysis	164
Predictiveness of GRT	165
Predictiveness of Questionnaires	166
<i>Qualitative Data</i>	166
Free-response Questionnaire.....	166
Reflecting on a Goal	166
Impact of GRT	168
DISCUSSION	170
CHAPTER SUMMARY.....	171
 CHAPTER 6. EXPLORING A GOAL-ORIENTED INTERVENTION AND COGNITIVE FLEXIBILITY IN THE ADAPTIVE CHOICE TASK	172
INTRODUCTION.....	172
<i>The Current Study: Research Questions and Predictions</i>	172
METHODS	174
<i>Participants</i>	174
<i>Measures and Stimuli</i>	174
Questionnaires and GRT.....	174
Adaptive Choice Task	174
<i>Design</i>	174
<i>Procedure</i>	175
GRT Procedure	175
ACT Procedure	176
RESULTS.....	177
<i>Reflective Tasks</i>	178
Descriptive Statistics	178
Frequentist Analysis	178
<i>Questionnaire data</i>	179
Descriptive Statistics	179
Frequentist Analysis	180
Difference between questionnaire score at T1 and T2	180
GRT relationship with Questionnaires Variables	184
<i>ACT Data</i>	186
Descriptive Statistics	186
Reaction Time.....	186
Accuracy	186
Optimality.....	186
RT	187
Frequentist Analysis	187
Predictiveness of GRT.....	188
Predictiveness of Questionnaires.....	189
<i>Accuracy</i>	189
Frequentist Analysis	189
Predictiveness of GRT.....	190
Predictiveness of Questionnaires.....	190
<i>Optimality</i>	191
Frequentist Analysis	191
Predictiveness of GRT.....	192
Predictiveness of Questionnaires.....	192
<i>Qualitative Data</i>	196
ACT Strategies	196
Target Selection Strategy.	196
Target Switching	196
Distractor Changes	197

Free-Response Questionnaire	198
Reflecting on a Goal	198
Impact of GRT	199
DISCUSSION	200
CHAPTER SUMMARY	202

CHAPTER 7: EXPLORING A GOAL-ORIENTED INTERVENTION AND COGNITIVE FLEXIBILITY IN THE ALTERNATIVE USES TASK.....203

BUILDING ON PREVIOUS STUDIES	203
THE CURRENT STUDY: RESEARCH QUESTIONS AND PREDICTIONS	203
METHOD	204
<i>Participants</i>	204
<i>Measures and stimuli</i>	205
Questionnaires and GRT	205
Alternative Uses Task (AUT)	205
<i>Design</i>	205
<i>Procedure</i>	206
GRT Procedure	206
AUT Procedure	207
RESULTS	208
<i>Reflective Tasks</i>	208
Descriptive Statistics	208
Frequentist Analysis	209
<i>Questionnaire data</i>	209
Descriptive Statistics	209
Frequentist Analysis	210
Difference Between Questionnaire Score at T1 And T2	210
GRT Relationship with Questionnaires	213
<i>AUT data</i>	214
Descriptive Statistics	214
Fluency	214
Flexibility	214
Elaboration	214
Originality	214
Error Rate	215
<i>Frequentist Analysis</i>	217
Fluency Data	217
Predictiveness of GRT	217
Predictiveness of Questionnaires	218
Flexibility Data	219
Predictiveness of GRT	220
Predictiveness of Questionnaires	220
Elaboration Data	221
Predictiveness of GRT	222
Predictiveness of Questionnaires	223
Originality Data	223
Predictiveness of GRT	224
Predictiveness of Questionnaires	224
Error Rate	224
Predictiveness of GRT	225
Predictiveness of Questionnaires	226
<i>Qualitative Data</i>	226
Free-response questionnaire.	226
Reflecting on a Goal	227
Impact of GRT	228
DISCUSSION	229

<i>GRT: Reviewing the Evidence</i>	231
CHAPTER SUMMARY.....	232
CHAPTER 8: DEAR DIARY: EVALUATING A GOAL-ORIENTED INTERVENTION LINKED WITH INCREASED HOPE AND COGNITIVE FLEXIBILITY	233
INTRODUCTION.....	234
<i>The Role of Hope</i>	234
<i>Can Hope Be Increased?</i>	237
<i>Purpose of the Current Study</i>	239
GENERAL METHOD	240
<i>Participants</i>	240
PHASE 1: QUANTITATIVE DATA	241
<i>Method</i>	241
Measures.....	241
Questionnaires	241
Alternative Uses Task (AUT; Guilford et al., 1978)	241
AUT Analysis	242
Procedure	243
Time One (T1): Before Diary Initiation	243
Time Two (T2): After Diary Completion.....	243
RESULTS.....	244
<i>Questionnaires</i>	244
Battery 1: Hope	244
Battery 2: Affect and Efficacy	245
<i>AUT</i>	245
PHASE 1 DISCUSSION.....	251
PHASE 2: QUALITATIVE DATA	253
<i>Method</i>	253
Materials	253
Goal Diary	253
End of Diary Questions	254
<i>Procedure</i>	254
<i>Data Analysis</i>	255
RESULTS.....	255
<i>How Do Participants Reflect on Their Goals?</i>	255
Positivity.....	255
Negativity	257
<i>Changes Throughout the Week and Moving Forwards</i>	258
Diary Issues	259
Benefits of Reflection	260
DISCUSSION: PHASE 2	261
GENERAL DISCUSSION.....	262
<i>Converging Quantitative and Qualitative Data</i>	262
<i>Study Implications and Future Directions</i>	263
CONCLUSIONS	265
SUPPLEMENTARY ANALYSIS.....	265
<i>Goals</i>	265
<i>Motivation</i>	267
SUPPLEMENTARY DISCUSSION	269
<i>Fitting into the Thesis and Chapter Summary</i>	270
CHAPTER 9: GENERAL DISCUSSION.....	272
SUMMARY OF RESULTS	272
<i>Card Sorting Task (CST): Studies 1-3</i>	272

GOAL REFLECTION TASK (GRT): STUDIES 4-6	274
GOAL-DIARY: STUDY 7	275
ANSWERING THE RESEARCH QUESTIONS... (POSSIBLY).....	276
EVALUATION OF METHODOLOGIES	277
<i>Mixed Methods and Convergent Data</i>	277
<i>Intervention Issues</i>	278
<i>CF Measures</i>	281
THEORETICAL IMPLICATIONS	282
<i>BBH and Character Strengths</i>	282
<i>A Triadic Relationship?</i>	283
<i>Distinctions in CF: Adaptive Optimality</i>	284
<i>Redefining CF</i>	289
<i>Future Directions</i>	290
FINAL REMARKS	292
REFERENCES	293
APPENDICES	318
APPENDIX 1- R2 STRENGTHS DICTIONARY, FROM R2 STRENGTH PROFILER (CAPP & CO, 2015).....	318
APPENDIX 2- THE STATE HOPE SCALE (SNYDER ET AL, 1994).....	319
APPENDIX 3- THE TRAIT HOPE SCALE (SNYDER ET AL, 1991).	320
APPENDIX 4- THE POSITIVE AND NEGATIVE AFFECT SCHEDULE (WATSON ET AL, 1998).	321

Tables and Figures

TABLE 1. LIST OF THE VIA-IS SIX THEMES, AND THE 24 ASSOCIATED CHARACTER STRENGTHS, ADAPTED FROM THE VIA-IS (PETERSON & SELIGMAN, 2004)	27
TABLE 2. A DESCRIPTIVE CLASSIFICATION SYSTEM FOR INTERPRETING BAYES FACTORS FROM WAGENMAKERS ET AL (2018)	84
TABLE 3. THE FIVE CATEGORIES OF STRENGTHS WITHIN THE CST.....	87
TABLE 4. MEAN PERCENTAGE (STANDARD DEVIATION IN BRACKETS) OF CARDS BY STRENGTHS CATEGORY AND QUADRANT.	93
TABLE 5. RTs IN MILLISECONDS (MS) FOR NT PERFORMANCE, BY PERCEPTUAL LEVEL, RESPONSE TYPE AND CONDITION	94
TABLE 6. ERROR RATE IN PERCENTAGE (%) FOR NT PERFORMANCE, BY PERCEPTUAL LEVEL, RESPONSE TYPE AND CONDITION	95
TABLE 7. RESULTS OF AN ANOVA COMPARING RTs FOR PERCEPTUAL LEVEL (PL), RESPONSE TYPES (RST), AND CONDITION, PLUS CORRESPONDING BAYES FACTOR.....	96
TABLE 8. RESULTS OF AN ANOVA COMPARING RTs FOR PERCEPTUAL LEVEL (PL), RESPONSE TYPES (RST), AND CONDITION, PLUS CORRESPONDING BAYES FACTOR.....	97
TABLE 9. EXAMPLES FROM EACH SUB-CATEGORY RELATING TO THE CONNECTION BETWEEN THE TASKS.	100
TABLE 10. EXAMPLES OF EACH OF THE SUB-CATEGORIES RELATING TO THE REFLECTING ON CHARACTER STRENGTHS CATEGORY.	101
TABLE 11. MEAN PERCENTAGE (STANDARD DEVIATION IN BRACKETS) OF CARDS BY STRENGTHS CATEGORY AND QUADRANT.	109
TABLE 12. ACT RT (MS), ACCURACY (%), AND OPTIMALITY (%), BY BLOCK AND CONDITION.	111
TABLE 13. RESPONSES AND FREQUENCY DATA FOR THE SUB-CATEGORIES RELATING TO TARGET SELECTION, SEPARATED BY CONDITION.	116
TABLE 14. RESPONSES AND FREQUENCY DATA FOR THE SUB-CATEGORIES RELATING TO TARGET SWITCHING, SEPARATED BY CONDITION.	117
TABLE 15. RESPONSES FOR EACH OF THE SUB-CATEGORIES RELATING TO DISTRACTOR CHANGES, BY CONDITION.	118
TABLE 16. EXAMPLES FROM EACH SUB-CATEGORY RELATING TO THE CONNECTION BETWEEN THE TASKS CATEGORY.	119
TABLE 17. EXAMPLES OF EACH OF THE SUB-CATEGORIES RELATING TO THE REFLECTING ON CHARACTER STRENGTHS CATEGORY.	120
TABLE 18. MEAN PERCENTAGE (STANDARD DEVIATION IN BRACKETS) OF CARDS BY STRENGTHS CATEGORY AND QUADRANT.	128
TABLE 19. DESCRIPTIVE STATISTICS FOR DEPENDANT VARIABLES MEASURED IN THE ALTERNATIVE USES TASK, BY CONDITION AND SECTION.	131
TABLE 20. EXAMPLES FROM EACH SUB-CATEGORY RELATING TO THE CONNECTION BETWEEN THE TASKS CATEGORY.	138
TABLE 21. EXAMPLES OF SUB-CATEGORIES RELATING TO REFLECTION ON CHARACTER STRENGTHS CATEGORY. ..	139
TABLE 22. QUESTIONS PRESENTED TO PARTICIPANTS IN THE GRT, AND EQUIVALENT CONTROL 'TYPICAL DAY' TASK	147
TABLE 23. MEAN NUMBER OF WORDS WRITTEN BY PARTICIPANTS BY CONDITION	152
TABLE 24. RESPONSES FOR SHS, THS (AGENCY/PATHWAY SUBSCALES) AND PANAS (POSITIVE/NEGATIVE SUBSCALES), BY BOTH TIME POINT AND CONDITION	153
TABLE 25. MIXED ANOVA RESULTS FOR DIFFERENCES BETWEEN T1 AND T2, BY INSTRUCTION CONDITION	155
TABLE 26. CORRELATIONAL ANALYSES BETWEEN GRT ENGAGEMENT AND QUESTIONNAIRES AT T1 AND T2	157
TABLE 27. REGRESSION ANALYSES SUMMARY FOR GRT ENGAGEMENT PREDICTING QUESTIONNAIRE SCORES AT T2	157
TABLE 28. RTs IN MILLISECONDS (MS) FOR NT PERFORMANCE, BY PERCEPTUAL LEVEL, RESPONSE TYPE AND INSTRUCTIONAL CONDITION	159

TABLE 29. RESULTS OF AN ANOVA COMPARING RTs FOR PERCEPTUAL LEVEL (PL), RESPONSE TYPES (RST), AND CONDITION, PLUS CORRESPONDING BAYES FACTOR.....	161
TABLE 30. CORRELATIONAL ANALYSES BETWEEN QUESTIONNAIRES AT T1 AND T2, AND RT (OVERALL AND COLLAPSED ACROSS PERCEPTUAL LEVEL AND RESPONSE TYPE).....	162
TABLE 31. REGRESSION ANALYSES SUMMARY FOR T1 QUESTIONNAIRE SCORES PREDICTING RT, COLLAPSED ACROSS PERCEPTUAL LEVEL AND RESPONSE TYPE.....	162
TABLE 32. ERROR RATE IN PERCENTAGE (%) FOR NT PERFORMANCE, BY PERCEPTUAL LEVEL, RESPONSE TYPE AND CONDITION	164
TABLE 33. RESULTS OF AN ANOVA COMPARING ACCURACY FOR PERCEPTUAL LEVEL (PL), RESPONSE TYPES (RST), AND CONDITION.....	165
TABLE 34. EXAMPLES OF EACH OF THE SUB-CATEGORIES RELATING TO THE REFLECTIVE TASKS	168
TABLE 35. EXAMPLE OF EACH SUB-CATEGORY RELATING TO THE IMPACT OF THE GRT GENERALLY	169
TABLE 36. EXAMPLES FROM EACH SUB-CATEGORY RELATING TO CONNECTION BETWEEN TASKS	170
TABLE 37. MEAN NUMBER OF WORDS WRITTEN BY PARTICIPANTS BY CONDITION	178
TABLE 38. RESPONSE FOR SHS, THS (AGENCY/PATHWAY SUBSCALES) AND PANAS (POSITIVE/NEGATIVE SUBSCALES), BY BOTH TIME POINTS AND CONDITION.....	180
TABLE 39. MIXED ANOVA RESULTS FOR TIME (I.E., DIFFERENCES IN QUESTIONNAIRE RESULTS FROM T1 TO T2), BY CONDITION	182
TABLE 40. CORRELATIONAL ANALYSES BETWEEN GRT ENGAGEMENT AND QUESTIONNAIRES AT T1 AND T2	184
TABLE 41. REGRESSION ANALYSES SUMMARY FOR T1 QUESTIONNAIRE SCORES PREDICTING GRT ENGAGEMENT, AND GRT ENGAGEMENT PREDICTING T2 QUESTIONNAIRE SCORE	184
TABLE 42. ACT RT (MS), ACCURACY (%), AND OPTIMALITY (%), BY BLOCK AND CONDITION	187
TABLE 43. CORRELATIONAL ANALYSES BETWEEN HOPE QUESTIONNAIRES (SHS, THS, PLUS AGENCY AND PATHWAY SUB-SCALES) AT T1 AND T2, AND OPTIMALITY	193
TABLE 44. REGRESSION ANALYSES SUMMARY FOR T1 AND T2 QUESTIONNAIRE SCORES PREDICTING OPTIMALITY	193
TABLE 45. RESPONSES AND FREQUENCY DATA FOR EACH OF THE SUB-CATEGORIES RELATING TO TARGET SELECTION, SEPARATED BY CONDITION	196
TABLE 46. NUMBER OF RESPONSES BY SUB-CATEGORY RELATING TO TARGET SWITCHING, BY CONDITION	197
TABLE 47. NUMBER OF RESPONSES BY SUB-CATEGORY RELATING TO DISTRACTOR CHANGES, BY CONDITION.....	198
TABLE 48. EXAMPLES OF EACH OF THE SUB-CATEGORIES RELATING TO THE REFLECTIVE TASKS	199
TABLE 49. EXAMPLE OF EACH SUB-CATEGORY RELATING TO THE IMPACT OF THE GRT GENERALLY	200
TABLE 50. EXAMPLES FROM EACH SUB-CATEGORY RELATING TO THE CONNECTION BETWEEN THE TASKS	200
TABLE 51. MEAN NUMBER OF WORDS WRITTEN BY PARTICIPANTS, BY CONDITION	208
TABLE 52. RESPONSES FOR SHS, THS (AGENCY AND PATHWAY SUBSCALES) AND PANAS (POSITIVE AND NEGATIVE SUBSCALES) AT BOTH T1, T2, BY CONDITION	210
TABLE 53. MIXED ANOVA RESULTS FOR TIME (I.E., DIFFERENCES IN QUESTIONNAIRE RESULTS FROM T1 TO T2), BY CONDITION	211
TABLE 54. CORRELATIONAL ANALYSES BETWEEN GRT ENGAGEMENT AND QUESTIONNAIRES AT T1 AND T2	213
TABLE 55. AUT FLUENCY, FLEXIBILITY, ELABORATION, ORIGINALITY, AND ERROR RATE (%), BY SECTION AND INSTRUCTIONAL CONDITION	216
TABLE 56. CORRELATIONAL ANALYSES BETWEEN QUESTIONNAIRES AT T1 AND T2, AND FLUENCY	218
TABLE 57. CORRELATIONAL ANALYSES BETWEEN QUESTIONNAIRES AT T1 AND T2, AND FLUENCY	221
TABLE 58. EXAMPLES OF EACH OF THE SUB-CATEGORIES RELATING TO THE REFLECTIVE TASKS	228
TABLE 59. EXAMPLE OF EACH SUB-CATEGORY RELATING TO GENERAL IMPACT OF THE GRT	229
TABLE 60. EXAMPLES FROM EACH SUB-CATEGORY RELATING TO THE CONNECTION BETWEEN THE TASKS	229
TABLE 61. MEAN QUESTIONNAIRE SCORES (STANDARD DEVIATIONS IN PARENTHESIS) BOTH T1 AND T2, BY GROUP	249
TABLE 62. MEAN AUT SCORES (STANDARD DEVIATION IN PARENTHESIS) ACROSS T1 AND T2, BY DEPENDENT VARIABLE AND GROUP	250
TABLE 63. PROMPTS AND QUESTIONS TO BE ANSWERED IN EACH DAILY DIARY ENTRY	253
TABLE 64. CATEGORIES OF GOALS IDENTIFIED, WITH OVERALL FREQUENCY AND EXAMPLE	266
TABLE 65. CATEGORIES OF MOTIVATION IDENTIFIED, WITH OVERALL FREQUENCY AND EXAMPLES	269

FIGURE 1. DIAGRAM OF EXECUTIVE FUNCTIONS AND THEIR HYPOTHESED INTERCONNECTIVITY, ADAPTED FROM DIAMOND (2013).....	43
FIGURE 2. DIAGRAM OF THE MULTICOMPONENT WM MODEL ADAPTED FROM BADDELEY (2010).....	46
FIGURE 3. A TYPICAL CORSI-BLOCK TASK ADAPTED FROM KESSELS ET AL (2000). BLOCKS ARE TAPPED IN ASCENDING NUMERICAL ORDER	47
FIGURE 4. SIMPLIFIED EXAMPLE OF PART A AND B OF THE TMT	55
FIGURE 5. EXAMPLE OF A WCST TRIAL, ADAPTED FROM MONCHI ET AL, (2001). THE 'TEST CARD' (ONE BLUE STAR) HAS THREE POTENTIAL MATCHES: NUMBER (BLACK TRIANGLE), SHAPE (GREEN STARS), AND COLOUR (BLUE CROSSES)	56
FIGURE 6. THE SPECTRUM OF MIXED METHODS RESEARCH, FROM QUALITATIVE-DOMINANT TO QUANTITATIVE-DOMINANT, ADAPTED FROM JOHNSON ET AL (2007)	66
FIGURE 7. EXAMPLE OF NAVON TASK STIMULI, WITH GLOBAL T/LOCAL H & GLOBAL H/LOCAL T.....	73
FIGURE 8. EXAMPLE OF A TYPICAL NT TRIAL FOR BOTH TARGET LETTERS, WITH THE CHANGES IN RESPONSE ALIGNMENT.....	74
FIGURE 9. TYPICAL ACT TRIAL. TWO CORRECT TARGET TRIALS ARE OUTLINED, PARTICIPANT WOULD PRESS 'B' FOR THE BLUE TARGET, AND 'N' FOR THE RED TARGET	76
FIGURE 10. DIAGRAM SHOWING POTENTIAL RESPONSES TO A HYPOTHETICAL AUT ITEM. I) HAS FOUR RESPONSES THAT ARE DIFFERENT FROM THE ORIGINAL USES (TO HOLD WATER), IN II) THE FOUR RESPONSES ARE REJECTED FOR EITHER BEING TOO SIMILAR TO THE ORIGINAL USE (E.G., CARRY AND POUR), NOT CLEAR WHAT THE USE IS (E.G., MELT), OR IMPOSSIBLE WITHOUT FURTHER INFORMATION (E.G., BALLOON)	77
FIGURE 11. ADAPTED VERSION OF THE QUADRANT FROM CAPP & CO (2015), WITH A BRIEF OF WHAT EACH CATEGORY RELATES TO. THE QUADRANT IS USED AS BOTH A PRACTICAL AID FOR PARTICIPANTS (I.E., WHERE TO SORT EACH CARD), AS WELL AS A REMINDER THROUGHOUT THE TASK TO WHAT EACH QUADRANT REFERS.	86
FIGURE 12. EXAMPLE OF A TYPICAL NT TRIAL FOR BOTH TARGET LETTERS, WITH THE CHANGES IN RESPONSE ALIGNMENT.....	88
FIGURE 13. GRAPH SHOWING RTs, BETWEEN PERCEPTUAL LEVEL AND RESPONSE TYPE BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.....	96
FIGURE 14. GRAPH SHOWING ACCURACY, BETWEEN PERCEPTUAL LEVEL AND RESPONSE TYPE BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	98
FIGURE 15. TYPICAL ACT TRIAL. TWO CORRECT TARGET TRIALS ARE OUTLINED, PARTICIPANT WOULD PRESS 'B' FOR THE BLUE TARGET, AND 'N' FOR THE RED TARGET.	105
FIGURE 16. GRAPH SHOWING RTs BY BLOCK AND CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.....	112
FIGURE 17. GRAPH SHOWING ACCURACY, BLOCK BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	113
FIGURE 18. SCATTERPLOT DEPICTING RELATIONSHIP BETWEEN CATEGORISED REALISED STRENGTHS CARDS AND ACCURACY.	114
FIGURE 19. BAR GRAPH SHOWING OPTIMALITY BY BLOCK AND CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	115
FIGURE 20. GRAPH DEPICTING THE DIFFERENCES IN FLUENCY SCORES BETWEEN SECTION AND CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	132
FIGURE 21. GRAPH DEPICTING DIFFERENCES IN FLEXIBILITY SCORES BETWEEN SECTION AND CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	133
FIGURE 22. GRAPH DEPICTING DIFFERENCES IN ELABORATION SCORES BETWEEN SECTION AND CONDITIONS. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	134
FIGURE 23. GRAPH DEPICTING DIFFERENCES IN ORIGINALITY SCORES BETWEEN SECTION AND CONDITIONS. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	135
FIGURE 24. GRAPH DEPICTING ERROR RATES (%) BETWEEN CONDITIONS BY SECTION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	136

FIGURE 25. EXAMPLE OF A TYPICAL NT TRIAL FOR BOTH TARGET LETTERS, WITH THE CHANGES IN RESPONSE ALIGNMENT.	149
FIGURE 26. GRAPH DEPICTING DIFFERENCES IN QUESTIONNAIRES SCORES BETWEEN T1 AND T2 BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	156
FIGURE 27. SCATTERPLOT SHOWING RELATIONSHIP BETWEEN THS, PATHWAY, AND AGENCY SCORES AT T2, AND MEAN NUMBER OF WORDS PRODUCED FOR THE GRT.	158
FIGURE 28. GRAPH SHOWING RTs, BETWEEN PERCEPTUAL LEVEL AND RESPONSE TYPE BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	160
FIGURE 29. SCATTERPLOT SHOWING RELATIONSHIP BETWEEN THS, PATHWAY, AND SHS SCORES AT T1, AND RT.	163
FIGURE 30. GRAPH SHOWING ACCURACY, BETWEEN PERCEPTUAL LEVEL AND RESPONSE TYPE BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	165
FIGURE 31. TYPICAL ACT TRIAL. TWO CORRECT TARGET TRIALS ARE OUTLINED, PARTICIPANT WOULD PRESS 'B' FOR THE BLUE TARGET, AND 'N' FOR THE RED TARGET.	177
FIGURE 32. GRAPH DEPICTING DIFFERENCES IN QUESTIONNAIRES SCORES BETWEEN T1 AND T2 BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	183
FIGURE 33. SCATTERPLOT DEPICTING RELATIONSHIP BETWEEN THS, PATHWAY, AND AGENCY SCORES AT T2, AND MEAN NUMBER OF WORDS PRODUCED FOR THE GRT.	185
FIGURE 34. GRAPH DEPICTING ACCURACY ACROSS BLOCK, BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	188
FIGURE 35. SCATTERPLOT DEPICTING RELATIONSHIP BETWEEN AVERAGE WORDS PRODUCED FOR THE GRT AND RT.	189
FIGURE 36. GRAPH DEPICTING ACCURACY ACROSS BLOCK, BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	190
FIGURE 37. GRAPH DEPICTING OPTIMALITY ACROSS BLOCK, BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	192
FIGURE 38. SCATTERPLOT DEPICTING RELATIONSHIP BETWEEN SHS, THS, AND AGENCY SCORES AT T1, AND OPTIMALITY.	194
FIGURE 39. SCATTERPLOT DEPICTING RELATIONSHIP BETWEEN SHS, THS, AND AGENCY SCORES AT T2, AND OPTIMALITY.	195
FIGURE 40. GRAPH DEPICTING DIFFERENCES IN QUESTIONNAIRES SCORES BETWEEN T1 AND T2 BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	212
FIGURE 41. LINE GRAPH DEPICTING RELATIONSHIP BETWEEN AGENCY SCORES AT T2, AND AVERAGE WORDS PRODUCED FOR THE GRT.	213
FIGURE 42. GRAPH SHOWING FLUENCY, SECTION BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	217
FIGURE 43. LINE GRAPH DEPICTING RELATIONSHIP BETWEEN SHS SCORES AT T2, AND AVERAGE FLUENCY.	219
FIGURE 44. GRAPH SHOWING FLEXIBILITY, SECTION BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	220
FIGURE 45. LINE GRAPH DEPICTING RELATIONSHIP BETWEEN SHS SCORES AT T2, AND AVERAGE FLEXIBILITY.	221
FIGURE 46. GRAPH SHOWING ELABORATION, SECTION BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	222
FIGURE 47. LINE GRAPH DEPICTING RELATIONSHIP BETWEEN ELABORATION SCORES, AND GRT WORD AVERAGE.	223
FIGURE 48. GRAPH SHOWING ORIGINALITY, SECTION BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	224
FIGURE 49. GRAPH SHOWING ERROR RATE, SECTION BY CONDITION. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	225
FIGURE 50. LINE GRAPH DEPICTING RELATIONSHIP BETWEEN ERROR RATE, AND GRT WORD AVERAGE.	226
FIGURE 51. DIFFERENCES IN QUESTIONNAIRE SCORES BETWEEN T1 AND T2. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN.	247
FIGURE 52. DIFFERENCES IN AUT OUTCOME SCORES BETWEEN T1 AND T2. ERROR BARS INDICATE ± 1 STANDARD ERROR OF THE MEAN. *TYPICALLY IN THE TEXT, ACCURACY HAS BEEN PRESENTED AS A PERCENTAGE, HOWEVER FOR CONSISTENCY IN FIGURE 2, THIS VALUE REFLECTS THE ABSOLUTE SCORE DIFFERENCE.	248

FIGURE 53. HYPOTHESISED TRIADIC RELATIONSHIP BETWEEN PID, COMPLEX CF, AND THE GOAL REFLECTION.	284
FIGURE 54. THEORETICAL DEPICTION OF ADAPTIVE OPTIMALITY.....	287
FIGURE 55. SIMPLIFIED ADAPTIVE OPTIMALITY MODEL AND ASSOCIATED BEHAVIOUR.....	287
FIGURE 56. VISUALIZATION OF HOW AO FITS UNDER THE CF UMBRELLA, WITH CF AS A CONTINUUM.	290

Acknowledgments

Undertaking this PhD has been a life-changing experience; I would like to thank the following people, without whom this would not have been possible.

The people who participated in my research, with special thanks the diary study participants for allowing me into your homes.

My friend and mentor Dr Elisabeth Blagrove, whose insight, knowledge, and encouragement enabled me to complete this degree. Thank you for your patience, and allowing me to learn so much from you. I relinquish the role of Debbie McGee.

Professor Derrick Watson and Dr Fiona MacCallum for your time, help, and support, I have learned much from you both. My peers, and now friends, I have met throughout my PhD; thank you for being such creative and inspiring people.

All of my friends and family, particularly my parents, for your support; thank you for putting up with me during write-up! Dexter and Daphne for keeping me smiling.

Finally, to Ben, quite simply, I could not have done this without you.

Publication Declaration

The following publication was produced as part of the work completed toward this thesis:

Hodson, L., MacCallum, F., Watson, D. G., & Blagrove, E. (2021). Dear Diary: Evaluating a goal-oriented intervention linked with increased hope and cognitive flexibility. *Personality and Individual Differences*, 168.
<https://doi.org/10.1016/j.paid.2020.110383>

The first author of this publication is the author of this thesis, the final author is their PhD supervisor. The first author completed all writing and analysis for the article, with support from the other named authors in reviewing and editing the manuscript.

Abbreviations

(in alphabetical order)

ACT- Adaptive Choice Task

AUT- Alternative Uses Task

CF- Cognitive Flexibility

CST- card sorting task

DSD- Data strand dominance

EF- Executive Function

GRT- Goal Reflection Task

H₀- Null Hypothesis

H₁- Alternative Hypothesis

MM- Mixed methods

NT- Navon Task

PANAS- Positive and Negative Affect Schedule

PP- Positive Psychology

PID- Positive Individual Differences

SHS- State Hope Scale

THS- Trait Hope Scale

TS- Task Switching

WM- Working Memory

Thesis Overview

This thesis aimed to address three key questions. Firstly, do character strengths enable people to *broaden and build* (Fredrickson, 2001)? Secondly, can the operation of The Broaden and Build Hypothesis extend to include cognitive flexibility (CF; i.e., rather than lower level cognition; memory, attention etc.)? Thirdly, do simple character strengths-based interventions (character strengths general, and hope-specific) impact on cognitive flexibility?

A mixed method approach was adopted to address these questions. Seven studies were conducted using both laboratory-based experiments and a naturalistic diary study methodology. A character strengths pseudo-intervention and novel hope-based goal-oriented intervention were designed and implemented, and their impact evaluated on three non-traditional measures of cognitive flexibility.

Overall, evidence supported extension of the Broaden and Build Hypothesis, and subsequent impact on complex CF, via goal-oriented intervention use. Efficacy of goal-oriented intervention was supported by both qualitative and quantitative data. Quantitatively, hope was reliably increased and negativity decreased after reflecting on an achieved goal. Moreover, participants who reflected on goals were found to perform better on fluency tasks (i.e., Alternative Uses Task; Guilford et al, 1977), and predictive relationships were found between increased hope, and optimality measures within the Adaptive Choice Task (Irons & Leber, 2015). Qualitatively, goal-reflection was considered to be an enjoyable activity (e.g., participants indicating continuing the activity post-study), enhancing wellbeing as determined by participants. Notably here, adoption of a mixed methods approach highlighted differences between qualitative and quantitative data strands, and improved holistic perspective enabled by their convergence. Implications of the findings include discussion around conceptualization of cognitive flexibility and operation of goal-oriented interventions, with future work suggested for the exploration of goal- setting and motivation, and potential distinction between simple and complex cognitive flexibility.

Chapter 1: Positive Psychology and Hope

Positive Psychology: A Brief Overview

One of the strongest positions from which to advocate positive psychology (PP) is its provision of an alternative to a traditional focus of psychological research (i.e., abnormal behaviour/phenomena; Gillham & Seligman, 1999). While work on abnormal behaviour clearly benefits humans (i.e., via increased understanding/ therapeutic development), in contrast, PP allows for more direct understanding of the character strengths and elements of wellbeing and fulfilment that contribute to 'everyday' human behaviour (Gillham & Seligman, 1999; Seligman & Csikszentmihalyi, 2000). More importantly, PP explores these factors using a robust empirical research framework, whereas other related perspectives (i.e., the humanistic view, Robbins, 2008) are often critiqued for their lack of empirical evidence in theory development (Peterson & Seligman, 2004)¹. In addition to this, experimental PP research has provided a new viewpoint on established cognitive domains, such as visual attention, memory, decision making and problem solving (i.e., Fredrickson, 2001; 2004). Even beyond the remit of psychological research, PP's focus is echoed in societal change, such as governmental policy (Cabinet Office, 2018), health care initiatives ("Wellbeing and mental health: Applying all our health", 2019), and higher education (Williams et al., 2018). These policy stances evidence the scope of PP and the potential it holds for understanding everyday behaviour, happiness, and flourishing.

The PP school emerged from the work a group of researchers whose main motivation was to explore human flourishing (see Seligman & Csikszentmihalyi, 2000 for a review). The intention was to present holistic understanding of human behaviour by exploring positive traits (e.g., character strengths) and experiences, and building positive infrastructure by enabling fulfilment and flourishing, both as a science and a wider society (Gillham &

¹ Although it is of note that this divide is disputed (e.g., see Waterman, 2013), with suggestions that PP and Humanism simply differ in their epistemological and ontological approaches

Seligman, 1999; Seligman, 2003). Indeed, their aim was not necessarily to consider the 'extraordinary' within, but instead "ordinary human strengths and virtues" (p. 216; Sheldon & King, 2001), and "...study of the conditions and processes that contribute to the flourishing or optimal functioning of people, groups and institutions..." (p.104; Gable & Haidt, 2005).

Although PP was established as a recognised field in the late 1990s, many of its fundamental concepts built on classic social psychology and humanism (i.e., personality, happiness; Diener, 2009; Robbins, 2008). An example of this is Maslow's (1943) *Hierarchy of Needs*, which highlights the role of fulfilling basic human wants (e.g., hunger, sex, sleep) in order to achieve more 'elevated' aspects of life (e.g., rewarding relationships, creative pursuits, achieving potential). Maslow emphasizes *self-actualization* as the ultimate level of fulfilment, but that the striving towards this goal necessitates the achievement (and maintenance) of more basic needs, lower in the hierarchy. Furthermore, even when higher levels have been attained, environmental or circumstantial changes can return us to lower levels; reinforcing an idea of on-going life-long striving. Interestingly, this also reflects the growth of PP in the face of increased longevity. As people are living longer, researchers aim to understand how this impacts on wellbeing (e.g., Steverink et al, 2005) and life-satisfaction (Diener, 2009; Gum, 2017; Robbins, 2008).

PP has faced particular critique (see e.g., Gable & Haidt, 2005) on the implicit (and intuitive) assumption that everything not explicitly considered positive is therefore negative (Diener, 2009). While this is patently not true (e.g., persistence might be considered a virtue, yet persisting in spite of negative outcomes may instead be obstinate or stubborn) it has arguably created a more critical audience for the philosophical underpinning of PP (e.g., Miller, 2008). For example, an assumption that negative traits are overlooked or ignored fails to take PP's overarching holistic approach into account that positive and negative traits are a duality and are equally fundamental to human nature (Seligman, 2003; Gable & Haidt, 2005).

A further point of criticism concerns the relevance of PP beyond the research domain. Specifically, there has been dispute over PP interventions and applications, in that these may have been ‘rushed’ into real-world operation, perhaps before there was sufficient evidence to support them (Diener, 2009; Seligman, et al, 2005). That said, it is possible to argue that the recent surge of PP research has effectively rectified this (Gallagher, 2017; Proctor, 2017).

Key Concepts in Positive Psychology

The Good, Pleasant, and Meaningful Life (Seligman, 2003)

A fundamental aim of PP is to understand the components of human motivation that enables the maintenance and increase of life-satisfaction (i.e., subjective wellbeing, balance between positive and negative affect; Linley et al, 2009). Seligman (2003) postulates three types of ‘life’ that an individual might pursue in their search for happiness. For example, *the good life* incorporates eudaimonic principles (e.g., see Ryff & Singer, 2008 for a review), in that happiness stems from positive traits, talents, and virtues. Thus, an individual is happy when they can use these talents and strengths (see also *flow*, below). Similarly, *the pleasant life* suggests that happiness stems from a life of enjoyment (e.g., hedonism; physical and bodily comforts), or that an individual is able to appreciate positive aspects of everyday life. Finally, *the meaningful life* places more emphasis on finding authentic meaning in our existence, by applying our personal strengths and virtues (e.g., through the betterment of others) and potential transcendence beyond the individual (i.e., connection to ‘something bigger’).

Flow

Flow is a PP phenomenon that the general public has found particularly appealing², entering discussions between experts and laypeople alike. Originally

² Relatively recently, a successful UK advertising campaign by Lucozade, encouraged the viewer to ‘Find Your Flow’ (Lucozade Energy, 2015); an effective demonstration of how PP can permeate the cultural zeitgeist.

conceptualized by Csikszentmihalyi, and subject to extensive exploration since the 1970's (Nakamura & Csikszentmihalyi, 2009), flow can be understood as an individual becoming completely absorbed in a moment. The focus is single-minded, with a loss of awareness for anything beyond the current objective (Nakamura & Csikszentmihalyi, 2009). Typically, the state of flow is associated with creative pursuits (e.g., art, writing), and requires a balance between challenge (or *action opportunity*) and skill (or *action capability*). If a given task does not meet this requirement, then the individual experiences anxiety or boredom instead, dependent on whether task demands exceed personal capacity or vice versa. Flow is associated with a loss of temporal experience, although there appears to be no 'typical' lengths of a flow state (Nakamura & Csikszentmihalyi, 2009). Flow has been investigated in a variety of settings, such as how it fluctuates in relation to attaining different goals types (Schweickle et al, 2017), and at work (Salanova et al, 2006). Flow is intuitively a desirable state, and one that is pursued as being a route to living a meaningful and satisfying life (Nakamura & Csikszentmihalyi, 2009), and therefore has sparked much focus (see Engeser, 2012 for a review). Flow has been associated with a variety of positive effects, including work satisfaction (Bryce & Haworth, 2002) and academic achievement (Heine, 1996). Furthermore, the 'real-world' applications of flow interventions have tangible benefits, including transforming failing workplaces (Marsh, 2006 cited in Nakamura & Csikszentmihalyi, 2009).

The Broaden and Build Hypothesis

Arguably, Fredrickson's (2001) work on the Broaden and Build Hypothesis (BBH) converges more effectively with more traditional aspects of psychology; specifically here, in exploring adaptive features of positivity. Notably, this theoretical framework contrasts strongly to behavioural features typically associated with adaptive behaviour (e.g., detection of negatively-valenced stimuli/affect) particularly associated with fight or flight responses. These include the narrowing of attentional lens and attention to negative

stimuli, and the interpretation of ambiguous situations as negative (Fredrickson & Branigan, 2005).

Conversely, positive affect has also been shown to have strong, potentially adaptive, value. It can broaden our cognitive functions, including our thought-action repertoire (T-AR; which enables novel/creative responses to stimuli; Fredrickson, 2001), as well as enhancing more specific cognitive abilities (e.g., attention, visual search; Fredrickson & Branigan, 2005; Isen, 1987). Lastly, this has been connected with reduced in-group/out-group thought patterns, with participants demonstrating less own-race bias with positive mood induction (Johnson & Fredrickson, 2005).

Overall, these behavioural benefits appear to be permanent, allowing the extended T-AR to be utilised in successively positive and divergent ways. In turn, this elicits more positive affect and further broadening, referred to as an *upwards spiral* (Fredrickson, 2001) in contrast to the familiar negative construct. Taken together these processes form the 'broadening' (i.e., increased cognitive resources) and 'building' (i.e., ability to actualise and use these resources) from which the framework was named. Taken to the extreme and considering long term implications, BBH can be considered equally as adaptive as fight or flight/threat response behaviour (Cohn & Fredrickson, 2011).

Subtly different to the positive effects frequently associated with BBH (e.g., social cognition), Fredrickson also proposed a BBH mechanism coined *the undoing effect* (Fredrickson et al, 2003; Garland et al., 2010). Specifically, this suggests that positive affect may be able to counter the impact of negative stimuli/stressors. For example, in a physiological study Tugade and Fredrickson (2004) as a result of positive affect saw a reduction in the impact of negative stimuli on participants' cardiovascular systems (e.g., less extreme reactivity to stimuli, more rapid return to baseline). Interestingly here, participants were able to draw positive meaning from their negative experiences, when asked to reflect on their coping with current problems (i.e., experiencing emotions such as eagerness or excitement as well as typical responses such as frustration).

Moreover, similar positive impact can be seen in other psychophysical responses. Cohen and Pressman's (2006) positive patient sample reported less pain and increased efficacy in dealing with their symptoms than their negative counterparts.

An assumption we might make about increased positivity, is that this only arises via brief laboratory induction or spontaneous processes in the individual. However, the benefits of BBH enhancement can also be induced via formal therapeutic-style interventions (e.g., Fredrickson et al 2008). Here, the authors demonstrated that increased daily positive affect (elicited via meditation) was related to increased life-satisfaction, decreased depressive symptoms, and an increase in personal resources (e.g., mindfulness, social support).

Character Strengths

As mentioned above, classification of positive individual differences (i.e., *character strengths*) has also become a focus of PP. Similarly to PP as a whole, this part of the literature does not seek to replace classic theory (e.g., personality theories such as The Big Five; Costa & McCrae, 1992), but instead aims for expanded, more holistic, understanding of the individual. In this instance, individual differences are not considered with neutral objectivity, applied universally on a continuum, or with the balance of positive and negative aspects (i.e., arguably a nomothetic trait approach). The assumption behind character strengths is that everyone possesses them (to a greater or lesser degree), but that individual differences reflect the strengths that are most important to each person (Peterson & Seligman, 2004). An individual will typically identify a smaller number of 'signature strengths', which more typically represent traits are particularly celebrated by that individual (Peterson & Park, 2009). The most common strengths are kindness, fairness, authenticity, open-mindedness, compared to the less common prudence, modesty, and self-regulation (Peterson & Park, 2009). Character strengths remain positive regardless of how they are represented within an individual (i.e., low gratitude

does not necessarily indicate an ingrate). Rather, an individual showing high levels of a particular strength means they resonate with a classified archetypal behaviour (i.e., a signature strength of *teamwork* would be typified by an individual working well with and as part of teams).

Intuitively, within the character strengths literature, we could assert that strengths are typically positively associated with affect; using our strengths elicits positive emotion. In fact, Harzer (2016) emphasized a high degree of shared variance between character strengths (especially emotional and interpersonal) and subjective wellbeing (i.e., the hedonic component of happiness), in his review, with robust correlations between strengths and positive affect per se. Overall then, while we can point to a substantial amount of overlap in everyday understanding of these constructs, as can be inferred by from their respective fields of research (e.g., CS; Park & Peterson, 2009; PA; Fredrickson & Losada, 2005), and linking of character strengths and positive affect in the technical literature (e.g., Güsewell & Ruch, 2012), we can still argue they are independent conceptually.

Measuring Character Strengths

Reflecting the drive to classify PP phenomena, Peterson and Seligman (2004) constructed a framework of 24-character strengths, based on individual difference traits (e.g., hope, cf practice or developed talents; Peterson & Park, 2009). Subsequently, this classification system has been held to be robust, incorporating both empirical and theoretical literature on character strengths (e.g., hope: Snyder et al, 1991; gratitude: McCulloch et al, 2002). More importantly, their framework has reflected differences in cultural and geographical values, organised under six over-arching themes (see Table 1 below).

The Values in Action Inventory of Strengths (VIA-IS; Peterson and Seligman, 2004) has been a popular measure of this framework; recent research developments have led to reduction from 240 to 96 statements (VIA-IS-M; McGrath, 2017). Participants rate their agreement with statements, using

a five-point Likert scale, scored against a list of most prominent to least prominent strengths (McGrath, 2017; Peterson & Park, 2009). The VIA-IS-M represents a gargantuan effort to produce a robust and reliable measure of character strengths, with a plethora of methodologies used (e.g., focus groups, interviews, content analysis of single-strengths measures; Peterson & Park, 2009), justifying its use as the most fitting measure of character strengths available.

Table 1. List of the VIA-IS Six Themes, and the 24 Associated Character Strengths, adapted from the VIA-IS (Peterson & Seligman, 2004)

Theme	Related character strengths
Wisdom and Knowledge: Cognitive strengths/ the acquisition and use of knowledge	Creativity (originality, ingenuity) Curiosity (interest, novelty-seeking) Judgement (critical thinking) Love of Learning (mastery of new skills) Perspective (wisdom)
Courage: Emotional strengths	Bravery (valor) Perseverance (persistence, industriousness) Honesty (authenticity, integrity) Zest (Vitality, enthusiasm, vigor, energy)
Humanity: Interpersonal strengths	Love (valuing close relationships) Kindness (generosity, nurturance) Social Intelligence (emotional/personal intelligence)
Justice: Civic strength for a healthy society/community	Teamwork (Citizenship, social responsibility, loyalty) Fairness (treating people equally) Leadership
Temperance: protection against excess	Forgiveness Humility Prudence (careful in one's actions and choices) Self-regulation (self-control)
Transcendence: Connection to wider environment/universe	Appreciation of Beauty and Excellence (awe, wonder) Gratitude Hope (goal-attainment) Humour (playfulness) Spirituality (faith)

(Adapted from the VIA-IS; Peterson & Seligman, 2004)

Character Strength Research

As classification and measurement of character strengths has been undertaken historically, recent research has focused on their behavioural

implications and how character strengths are represented differentially (see Heintz et al, 2019 for a review). Correlational research highlighted strengths such as hope, gratitude, and love were found to be associated with life-satisfaction (Park et al, 2004), also including zest in younger populations (Peterson & Park, 2009). One particular focus has been character strengths in the workplace. For example, the strengths of hope, persistence, zest, and curiosity were associated with people having healthier work-related behaviour and experiences (Gander et al, 2012).

After a focus on application, a natural avenue is the exploration of intervention and augmented benefit. In fact, recently, character strengths have been recognised as a key area of intervention development (Linley et al., 2007), particularly in schools (Linkins et al, 2015). This has led to a strong evidence base, demonstrating (inter alia) increased life-satisfaction following character strengths-based exercises (Proctor et al, 2011) and increased social skills and engagement in schools (The Positive Psychology for Youth program; see Gillham & Seligman, 1999; Seligman et al, 2009).

Importantly, while character strengths remain distinct within the literature (Niemiec, 2013), they reflect many core values of the field. For example, the life 'styles' identified by Seligman (2003; e.g., the good and meaningful lives) above, emphasize the role of an individual's talents and/ or character strengths in gaining life-satisfaction and fulfilment. However, in turn, this highlights the other purposes character strengths might have- distinct within the literature or held in common with other PP constructs (i.e., long-term behavioural implications).

A potential candidate for such commonality is the BBH (e.g., Fredrickson, 2004, see above), according to which adaptive functions of positive affect are shown with benefits to the T-AR. Character strengths, designated as positive individual differences (i.e., traits), illustrate how the BBH may extend beyond its current remit. At a basic level, individual traits may elicit the affect needed for BBH to actualise; thus, possessing a particular strength would provide that

individual with an adaptive advantage. Indeed, the predictiveness of character strengths, in some instances accounting for greater variance than positive affect per se, life-satisfaction, optimism, self-efficacy, and self-esteem (e.g., see Martínez-Martí and Ruch, 2016), suggests that they may play a more integral role than simply facilitating positive affect. Indeed, BBH serves as an example of how both PP, and its facets, are an integral field in understanding the long-term implications of positive affect and behaviour.

Hope

Hope can be understood as future-oriented thinking, specifically, the ability to successfully attain goals, with an emphasis on sustaining motivation and overcoming obstacles (see Callina et al, 2017 for an overview; Snyder et al., 1991; Snyder et al, 2003).³ Goals are designated as targets set by an individual, reflecting subjective ambitions/ aspirations, varying in duration (i.e., short, mid or long term), specificity, and meaning (Rand & Cheavens, 2009).

According to the literature (e.g., Snyder et al., 1991, 2003; Rand & Cheavens, 2009) hope is formed from two distinct features; *agency* and *pathways*. *Agency* is broadly synonymous with motivation, enabling the individual to focus on attainment of a desired goal. In contrast, *pathways* is specifically related to overcoming obstacles, and planning the most appropriate route needed to achieve the goal. Overall, neither aspect of hope is held to be more important (see Snyder above), however, an individual's hopefulness is dependent on the interaction between the two. In other words, an individual with high hope will be able to plan a route to goal attainment effectively, adapting as necessary, and sustaining the necessary motivation. Persistence in pursuit of goals is sustained through goal appraisal and feedback (i.e., does the outcome remain the same/is it worth continuing?), allowing for an adaptive

³ Hope and optimism are frequently used interchangeably (e.g., Peterson & Seligman, 2004). While these constructs are closely related, optimism is generally considered a dispositional outlook (i.e., rather than focus on goal actualisation and attainment) with an emphasis on future-oriented thinking, or that 'good things will happen' (Carver et al., 2009). While hope semantically appears similar, its behavioural implications (i.e., agency, pathway behaviour) highlight the difference, therefore the two constructs have been considered distinct for the purposes of this thesis.

response to any situational change. Agency and pathways also appear reciprocal, an increase in one indicating an increase in the other (Gallagher, 2017).

That said, hope is not necessarily a 'permanent' trait, contrasting the standard view of trait stability (e.g., consistent and reliable across environments and time). This makes intuitive sense, as failure to achieve goals would suggest a reduction of hope (Snyder et al., 2002). However, initial development of hope emerges in childhood, with pathways ability increasing with knowledge of event causality and temporality (i.e., cause and effect of events, temporal proximity). Further, agency ability develops as children learn they can potentially affect these events (Rand & Cheavens, 2009). Overall, the characteristic abilities and qualities comprising the hope construct develop as an individual recognises the achievement and satisfaction associated with goal attainment, and subsequently, pursue their next goal to reinforce these positive feelings.

The prevalence of hope throughout history further signify its role in current research. Historically, hope has been a central concept in human society (e.g., inspiring art and literature), taking a fundamental place in religions such as the Abrahamic faiths (Selvam & Poulson, 2012). Hope has also been considered a virtue to be cultivated and cherished in society (Callina et al., 2017; Gallagher, 2017), with the work of some early psychotherapists (e.g., Tiger, 1979) advocating hope as a potent trait necessary for development. While some aspects of hope have waned in societal relevance, such as Pandora and her box of evils ⁴, it has inspired a plethora academic research.

Finally, it is worth noting that since the inception of hope scales by Snyder in the early 1990s, some aspects of the theory and its application have been questioned. Aspinwall and Leaf (2002) highlight that hope is conceptually related to other constructs (e.g., self-efficacy, optimism), and this should be factored into our conceptualisation of hope. Moreover, Tong et al (2010)

⁴ Although, the allegory remains a particular favourite of academics studying hope and is used frequently in literature reviews (e.g., Gallagher, 2017). While beyond the scope of the current thesis, that hope is the only 'evil' left in the box raises a philosophical question on inherent value of hope.

conducted a series of studies to better understand the agency- and pathway subscales. Through examining peoples' understanding of hope as a concept, they found that only trait agency was positively associated with hope, not pathways. While they caution to not overstate their results, this does serve to highlight that hope- and positive psychology more generally, is a relatively new and dynamic field of study.

Hope Research

Hope in the Workplace. As with the more general construct of character strengths above, hope has been investigated in a variety of applied settings. In this literature, one focus has been strongly occupational in nature; hope has been associated with higher levels of better-quality workplace performance, particularly regarding effective goal-setting and pro-social behaviour (e.g., teamwork; Reichard et al, 2013). In addition, hope has been connected with flow (see *Flow* above) and passion in the workplace, with all three constructs significant predictors of workplace performance (Mouton, 2015; Mouton & Montijo, 2018). In turn, the experience of positive emotions increases levels of work-related hope (Ouweneel et al, 2012).

Hope and Academic Achievement. However, the empirical literature has not only addressed implications of levels of workplace hope. A wide range of research has highlighted the role hope can play in adolescent well-being, especially in academic settings (e.g., Day et al, 2010; Snyder et al., 2002). Here, hope correlates with academic achievement and predicts performance (specifically, reduction in drop-out rates, superior grades), even after controlling for intelligence, self-esteem, and previous academic performance (Snyder et al., 2002). Moreover, evidence from longitudinal work has shown hope to be the best predictor of grades and positive affect in high-school students (Ciarrochi et al, 2007), positive psychological well-being (Singh et al, 2012), and global life satisfaction (Gilman et al, 2006; see also Marques et al, 2013, for an examination of hope and spirituality in adolescents). As a whole, hope appears to be a unique predictor of academic performance, outperforming intelligence,

personality, and previous academic performance in accounting for variance (Day et al., 2010).

Hope and Health. The scope of investigation into hope is not constrained to issues of human performance. As might be expected, there is an extended corpus that examines the impact on health, both mental and physical. Individuals with high levels of hope appear to cope with illness, injury, and sensory impairments more effectively (Jackson et al, 1998). In contrast to low hope individuals, pain was reported less frequently and less severely, and both effects have also been evident when translated to a non-medical context (e.g., cold-pressure tasks; Snyder et al., 2005; pain catastrophizing; Hood et al, 2012; Berg et al, 2008). Arguably then, these studies suggest a privileged position for hope in enabling better coping strategies for and tolerance of physical illness and pain.

Alternatively, hope might be indicated as a mediating factor, rather than a causal mechanism in such effects. Thus, facilitation of resource-seeking and enhanced support networks may lead to more effective coping with physical stressors than hope per se (Rasmussen et al, 2018). This viewpoint is strengthened by the range of healthy behaviours attributed to individuals with higher levels of hope (e.g., decreased use of alcohol and tobacco; Berg et al, 2011; healthier food choices; Nollen et al., 2008; Nothwehr et al, 2013; and increased physical activity; Berg et al., 2011; Nothwehr et al., 2013).

In addition to such physical advantages, hope has also been associated with positive changes in mental health. Similarly to the medical context above, higher hope individuals are generally better at generating effective strategies to deal with stress (Snyder et al., 1991), rather than adopting the avoidance behaviours associated with lower levels of hope. Similar benefits have been seen with decreased symptoms of depression (see Alarcon et al, 2013 for a review). In fact, evidence from eye-tracking indicates that this is also reflected in the allocation of attentional resources; higher hope participants focused less on dysphoric and threatening stimuli (Kelberer et al, 2018). In turn, this was

highlighted as a potential mechanism by which individuals might reduce psychological distress- echoing the undoing effect postulated under the BBH (e.g., Fredrickson, 2001).

Hope and Wellbeing. More intuitively, hope has also been connected with higher levels of positivity, specifically increased flourishing and well-being (Gallagher & Lopez, 2009). An association with higher levels of life-satisfaction, well-being, and perceived physical well-being (e.g., Wroblewski & Snyder, 2005; here in an adolescent sample). That said, beyond this intuitive relationship, there is evidence of a reciprocal mechanism, where goal orientation and attainment (as key components of hope) have been connected with increased happiness, and failed attainment with frustration and anger (Bagozzi & Pieters, 1998).

Hope Research in Summary. Taken as a whole, the behavioural, cognitive, and social benefits associated with higher levels of hope above suggest that this particular character strength confers potential evolutionary advantages. Overall, higher hope individuals are better able to cope with stressors (Jackson et al., 1998; Kelberer et al., 2018), make better decisions (Nothwehr et al., 2013), and interact more effectively with others (Reichard et al., 2013). Given these important benefits, it is not surprising that research focus has turned towards robust methods of increasing levels of hope in individuals and groups.

Improving Hope

Collectively, PP interventions appear to be proliferating (see Proctor, 2017). A recent meta-analysis on PP interventions assessed via randomised control trials (RCT) included 50 studies (Hendriks et al., 2019), not counting the plethora of other research which did not meet the analysis requirements (i.e., none RCT's, interventions that focused on a single component such as forgiveness therapy). Looking more closely at hope-based interventions, these have been used extensively in therapeutic/clinical settings, with a clear 'track record' of increasing agency thinking (Cheavens et al, 2006; Klausner et al.,

1998), self-esteem and life-satisfaction. Generally, such interventions address the two facets of hope (i.e., agency and pathways) separately (Cheavens & Guter, 2017). For example, pathways tasks typically focus on goal-mapping (i.e., planning and adapting routes to goals), whereas agency interventions promote motivation, working to adjust the thought patterns needed to actualise goals. However, hope has also been considered more holistically, with interventions working on goal-setting behaviour (known as goal stretching or “goldilocks” goals; Pedrotti et al, 2008). By encouraging individuals to set goals that challenge them, and promoting self-concordant (i.e., subjectively relevant) goals, we can facilitate development of hope- oriented thinking. In turn, this increases positive feedback, thereby reinforcing the positive feedback loop (Koestner et al, 2002).

Echoes of the humanistic school (i.e., teleological development and lifelong striving for self-actualization; e.g., Ryff & Singer, 2008) can be seen as hope interventions have also been used with participants at both ends of the lifespan. In educational settings, the *Making Hope Happen Program* worked with children over five weeks (Pedrotti, 2017; also see Pedrotti et al., 2008), in groups between eight to ten, each session lasting around 45 minutes; the children were paired up as ‘hope buddies’ and worked together to review progress after each session. The children were guided through activities such as The Hope Game where players needed to acquire both agency and pathways cards in order to progress, emphasising the necessity for both elements. Increased levels of overall hope (in addition to agency and pathways scales) were found by the end of the intervention measured using the Children’s Hope Scale (Snyder et al., 1997), and were also found to have been sustained six weeks later. Similarly, working with older adults (aged 55+), goal-focused group psychotherapy elicited improved goal-setting and actualisation behaviour (Klausner et al., 1998; also see Gum, 2017). Moreover, participants who received this goal-based therapy also increased in hope, and social functioning, while decreasing in hopelessness and anxiety.

On the other hand, a meta-analysis by Weis and Speridakos (2011) has also highlighted variability in intervention effectiveness. Out of the 27 studies included, seven represented single interaction programmes, with 19 multiple session interventions. Generally, hope levels appeared to increase more substantially ($d = .40$) if administered in a one-off session compared to multi-session programs ($d = .19$). Further, laboratory setting returned larger increases ($d = .39$) than those dispensed in health settings ($d = .18$). However, the researchers also pointed to different samples ‘typically’ used in each setting (e.g., long-term interventions in clinical settings, with over-representation of special populations etc.); this may account for any disparity in findings.

Measuring Hope

General strength measures (e.g., VIA-IS-M; McGrath, 2017; Peterson & Park, 2009) can clearly be used to determine an individual’s levels of hope. However, as hope is one of 24 strengths measured, the test may lack the focus of a single-trait measure, and/or the data include an unacceptable level of noise. Notably, the VIA-IS measure also does not distinguish between state and trait hope. While these constructs are not unrelated, it is important to explore them individually, if our aim is to achieve a comprehensive understanding of this character strength.

State hope (e.g., event-reactive and transitory hope levels), can be measured using the State Hope Scale (SHS; Snyder et al., 1996). The SHS consists of six items (i.e., three agency- and three pathways- related), with responses using an 8-point Likert scale ($1 = \textit{Definitely false}$, $8 = \textit{Definitely true}$) and participant instructions to respond based on feelings ‘in that moment’. The SHS is considered highly reliable, with Cronbach’s alpha values ranging from .82 to .95, with test-retest reliability of .80.

Trait hope (i.e., dispositional, enduring levels of hope) can be measured using the Trait Hope Scale (THS; Snyder et al., 1991)⁵. The THS is also considered

⁵ This measure is also referred to as the Adult Dispositional Hope Scale

highly reliable and replicable scale; values of Cronbach's alpha ranged from .74 to .84, with test-retest reliability of .80. The scale consists of 12 statements (i.e., four agency, four pathways, four distractor statements). As above, participants rate each statement using an 8-point Likert scale (*1 = Definitely false, 8 = Definitely true*). Both scales are well-regarded and regularly used in research (see Rose & Sieben, 2018). Further, they have been found to complement the VIA-IS-M classification, providing in-depth exploration that builds effectively on more general levels of examination.

Moving Beyond the Research

In summary, PP's emphasis on human flourishing and fulfilment (e.g., achieving 'The Good Life'; Peterson & Seligman, 2004) provides a strong base from which individual differences (e.g., adaptive behavioural traits) can be explored. This is especially highlighted by Frederickson's work (e.g., BBH; 2001), indicating behavioural benefits to domains as diverse as cognition, social intelligence, and affect. The *hope* character strength itself is well-documented (e.g., see Snyder et al., 2005), and illustrates the potential link between this aspect of positivity and adaptive behaviours. However, an important question also emerges from this idea; why have such sophisticated (and potentially, 'elevated' - according to earlier schools of psychological thought; e.g., Maslow, 1943) human behaviours become part of our everyday task-oriented behaviour?

It seems a truism of evolutionary theory that such traits must have had some adaptive function, or exist as by-product of an adaptive behaviour (Badcock, 2003). Indeed, empirical support for the theoretical framework of PP indicates multiple connections to both psychological and physiological development (Fredrickson, 2001; Peterson & Seligman, 2004; Fredrickson & Losada, 2005) and on-going importance over the lifespan (Seligman, 2004). Thus, it seems feasible that such behaviourally-relevant strength traits might influence task performance more generally.

Finally, with detailed review of character strengths, and a key aim of this thesis in mind (i.e., to develop and explore character strength-based

interventions), the connection between character strengths and positive affect must be acknowledged (e.g., Harzer, 2016; see *Character Strengths* above). In a pragmatic sense, character strengths and affect might be considered mutually facilitatory, with character strengths enabling positive affect and vice versa. As such, any attempt to disentangle them via interventions or measures would be difficult. That said, character strengths and affect are conceptually distinct, with a wealth of literature and understanding dedicated to each field independently (e.g., McGrath, 2017; Gable & Harmon-Jones, 2008, respectively). Importantly, disentangling these concepts is beyond the scope of this thesis. Thus, while this debate is acknowledged, moving forwards, character strengths and affect will be considered as distinct for the purpose of this work (and specifically, intervention development).

Chapter two will explore the ‘umbrella’ construct of cognitive flexibility, its relationship with executive functions, and specific behaviour associated. In addition, the overarching, high-level cognitive ability explored above, will be used to illustrate how BBH may be extended beyond both simple positivity and isolated cognitive functions (e.g., attention, visual search).

Chapter 2: Flexible Thinking- What is Cognitive Flexibility?

The overarching aim of this thesis is to explore the adaptive functions of positive individual differences. Within the Positive Psychology literature, the BBH (Fredrickson, 2001; see Chapter 1) provides an effective framework for this exploration (i.e., enhanced cognition, behaviour, and thought-action repertoire; T-AR). However, although robust evidence supports the operation of the BBH (e.g., Fredrickson and Branigan, 2005), the definition of this general cognitive/behavioural improvement (i.e., enhanced T-AR; see *Chapter 1*) is limited, with no clear scope for which of cognition may be implicated. This chapter aims to fill this gap in our understanding by examining Cognitive Flexibility (CF); the ability to switch between mental processes quickly and effectively in order to behave appropriately in any given environment (Dajani & Uddin, 2015). Even by this brief definition, one can intuit an overlap between BBH and CF. By developing a more coherent understanding of CF, and the interplay between these two concepts, we can move beyond intuition, and provide a framework which can be explored in this thesis.

CF will be explored in more depth below, with a view to providing a detailed insight into the associated behavioural and cognitive abilities involved. Firstly, I will review current understanding of the CF construct, including an overview of executive functions (EF) and how they relate theoretically and practically with CF. Next, I will explore more general CF research, other closely-linked cognitive constructs, and traditional measures of CF. Finally, I will distil these diverse ideas into a ‘working definition’ to enable its use as an effective ‘vehicle’ to explore the operation of BBH and more specifically, character strengths; the literature surrounding CF is often inconsistent (and perhaps even confusing), and therefore will need to be consolidated in the development of a working definition.

What do we know about CF?

In its most simplistic form, CF is part of everyday human behaviour, allowing an individual to reconfigure their thoughts and switch between tasks

(Braem & Egner, 2018). An (unfortunately) banal example of CF is organising laundry, switching focus between fabrics and colours to organise clothes, or even shape and size when pairing socks. Here, the individual is able to switch between behavioural responses, based on the changing stimuli in their environment (e.g., pairing the green socks, folding a shirt), whilst maintaining both a general task objective and specific task demands.

The concept of CF has prompted much debate (see Diamond, 2013; Dick, 2014; Gonzalez et al., 2013), with a more nuanced definition of the concept developing over the last 60 years. One of the earliest definitions from Scott (1962) focuses on a more ‘top-down’ approach to CF, connecting to an individual’s ‘concept system’ and its application to different environmental stimuli. Arguably, Scott uses a lexical approach (i.e., specifically Nations or Countries) and measures flexibility based on the ‘dimensional complexity’ of how meaningfully stimuli are grouped together (e.g., geography, name, political ideology). In contrast, Martin and Anderson (1998) understood CF as a general resource that an individual taps into at all times, allowing wider awareness of the behavioural options available and the capacity to act flexibly. Adding to the complexity of our understanding, Canas et al (2003) suggest CF can be cultivated. Children as young as three have engaged successfully with paradigms which test CF (Diamond, 2005) and demonstrated skills associated with this high-level set of cognitive abilities. More recently, CF has been presented as allowing an individual to adapt *how* they think about an item or concept (i.e., ‘lateral thinking’), maintaining the flexibility to adapt to a changing environment, and to think and act in more creative ways (Dreu et al., 2011).

The Neuroscience of CF

CF also spans into the field of neuroscience, with an emphasis on exploring brain regions associated with CF (see Barbey et al., 2013). For example, Dajani and Uddin (2015) suggest an interplay between nodes within the frontal and parietal cortices, nodes which are also typically associated with EFs such as WM and IC. Further, individual differences in CF have been shown to be

predicted by dopamine receptor levels in different brain regions (i.e., prefrontal cortex; Samanez-Larkin et al., 2013; see O'Reilly, 2013). While consideration of the minutiae of the neural networks involved in CF are beyond the scope of this thesis, the differences in developmental trajectories in different nodes (i.e., IC is developed as early as 12 months, compared to the continuing development of WM from toddler to early adult) suggest that CF starts to be seen in children as young as four years old.

Moreover, Dajani and Uddin (2015) highlight the detrimental impact of neurodiversity and/or executive dysfunction (e.g., autistic spectrum disorder, obsessive-compulsive disorder) can have on CF, with neuroimaging studies underlining the differences in brain activation between neuro-diverse and neuro-typical children (although there is very little agreement as of yet about the specifics of these differences). Interestingly, while neuroscience can offer some insight into the effect of brain impairment on CF, it has also had a profound effect on the typical method and measures used to assess CF, with many being designed specifically for use in clinical settings (see *Typical measures of CF* below).

Conceptual issues

At this point already, it is clear there are issues in conceptualizing CF in precise terms- and reaching a broad consensus. These issues will be explored in more detail below (see *A Pragmatic View of CF*), however, the general point is well illustrated by Koch et al's (2018) review of CF research (specifically task-switching) attempting more integrative and specific understanding of the concept. Koch et al argued that typical research approaches (e.g., focusing on cognitive structures or brain architecture) led to paradigmatic constraints (i.e., dual-task paradigms). In turn, they argue that this limits understanding, and impacts negatively on generalisability. They also assert the need for adoption of more comprehensive and integrative approaches, which acknowledge that any central CF mechanism encompasses a broad range of CF-related skills.

Braem and Egner (2018) challenge the traditionally conceptualized supervisory role of CF. They contest the view that CF is a mechanism via which all associated cognition and behaviour are ‘administered’ (e.g., Diamond, 2014). Instead, they posit that associative-learning mechanisms are more relevant to CF operation, and that contextual cues (specific stimuli in an environment e.g., differences faces; see Chiu & Egner, 2017) are downplayed in traditional models outlined above. In particular, they suggest more emphasis should be placed on the role of bottom-up environmental cues (e.g., colours, locations etc.) in triggering CF processing. This approach would suggest that CF is domain- (or behaviourally-) specific. In more pragmatic terms, just because someone has learned to be cognitively flexible in one situation, does not necessarily mean this can be applied to other situations or environments.

Regardless of our precise conceptualization of CF, much of the contention surrounding its treatment in the literature is its interconnectedness with other aspects of high-level cognitive functions. For example, this is characterized particularly strongly in the case of Executive Functions (EFs), as CF may be both the product of, and a facilitator for all EFs (Cañas et al., 2003; Diamond, 2005). In turn, this is reflected in CF measurement, which has documented the difficulty in separating CF from other higher cognitive processes (for EF specifically; i.e., Dick, 2014; Miyake & Friedman, 2012; Miyake et al., 2000; see *Traditional measures of CF* below). Additionally, as EFs permeate much of the literature on higher-order cognitive functions, it is important to understand how these aspects relate to, overlap with, and are distinct from the ‘working definition’ of CF this chapter aims to provide.

What are Executive Functions?

Broadly speaking, EFs pertain to the ‘supervisory’ mental processes used when attending to, or concentrating on, stimuli (e.g., moving cognitive resources from one task to another; Diamond, 2013), rather than higher level processing (e.g., reasoning), or lower level cognitive functions (e.g., attention). EFs are distinct from automatic/intuitive attention which is habitual (i.e., subcortical

attention; Mangun et al., 1994); instead, effort is expended to attend to stimuli in a focused and deliberate way. In addition to attention, EFs are used to regulate and process information before selecting an appropriate behavioural response (Fernandez-Duque et al., 2000), for example, one might avoid repeating a current action, when a new one is needed to complete the current task (Diamond, 2013).

The review literature (see e.g., Diamond, 2013; Jurado & Rosselli, 2007; Miyake et al., 2000) generally highlights two ways of categorising EF. The first can be labelled by cognitive function alone (i.e., updating, switching, and inhibition; Diamond, 2013), with the second indicating cognitive constructs, or what might be considered an ‘applied’ version of the first set of functions (i.e., Working Memory, Inhibitory Control, Task Switching; Miyake et al., 2000). For the purposes of this chapter, the focus will be on the second approach, cognitive constructs. Primarily, this is because the original BBH research corpus is loosely aligned with this approach (although not necessarily by name; see Chapter 1). However, this is not to dismiss the depth of the theoretical debate in the literature. The second reason for adopting this focus is simple convenience, given that this thesis is not based on EF research, nor is detailed exploration of these points particularly constructive for gaining clear understanding. To this end, Figure 1 below highlights the EF construct hierarchy suggested by Diamond (2013); note that CF is depicted as central, connecting the core and higher functions. Additionally, *task-switching* has been added, to reflect its prominence within the wider literature (e.g., Miyake et al, 2000) beyond the Diamond model.

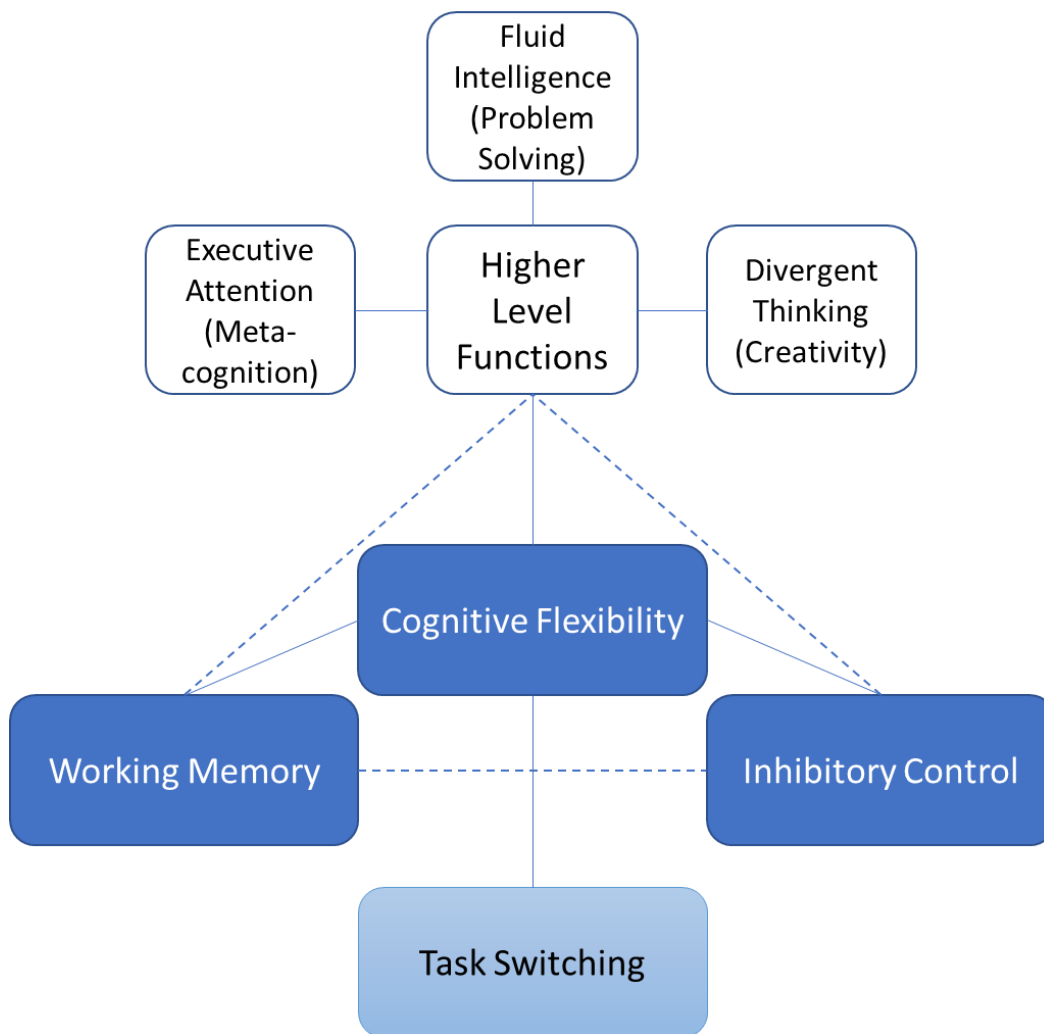


Figure 1. Diagram of Executive Functions and their hypothesised interconnectivity, adapted from Diamond (2013)

Inhibitory Control

Inhibitory Control (IC) can be understood as the capacity to control responses (e.g., behaviour, thoughts, affect) to stimuli and enable an individual to act with agency rather than by impulse or with habitual responses (Miyake et al., 2000). This functionality allows people to think and act deliberately, choosing their response to allow for flexibility in any given scenario (Verbruggen & Logan, 2008). Coming back to our laundry example, an individual can focus on selecting dark-coloured items only, while ignoring lighter ones (i.e., selective attention; Theeuwes, 2010). Here, the individual is able to ‘inhibit’ selecting the other type of clothing. However, IC is limited, and stimuli personally relevant to the

individual (e.g., a particularly smelly light-coloured sock) may force attention, or an impulsive reaction (i.e., involuntary attention; Theeuwes, 2010), therefore overwhelming IC.

The applications of IC also extend across sensory modalities and function. For example, IC may enable individuals to control thoughts, and purposefully suppress memories they no longer want recall (Anderson & Green, 2001; Anderson & Levy, 2009; Diamond, 2013). Furthermore, inhibition can be applied to impulsive behaviour (i.e., self-control; Diamond, 2013; cf Fujita, 2011), a person inhibits by resisting temptation (e.g., to overindulge, to react to another's behaviour). Self-control enables the individual to stay focused and avoid distractions, allowing time to think and adhere to social norms (Diamond, 2013), echoing the control displayed in attentional inhibition above. However, it is important to note that the constructs are distinct, and self-control extends beyond simple impulse inhibition (Fujita, 2011). In addition, within the PP literature, self-control has also recently been classified as central virtue, applicable as a concept across cultures (see McGrath, 2015).

Moreover, the various cognitive and behavioural functions of IC (e.g., inhibiting attention, and inhibiting action) have been found to correlate strongly, supporting the theoretical assertion of an underlying central mechanism, which underpins the disparate aspects of inhibition (Friedman & Miyake, 2004; Miyake & Friedman, 2012). Finally, IC has been tested in laboratory settings using well-established paradigms, such as the Stroop task (MacLeod, 1992; Stroop, 1935), the Flanker task (Eriksen & Eriksen, 1974; Sanders & Lamers, 2002), and the Go/No-Go task (Verbruggen & Logan, 2008).

Working Memory (WM)

Working Memory (WM) is also considered a core EF (see Figure 1; also see Diamond, 2013; Miyake & Friedman, 2012), and is conceptualised as the ability to keep information 'active in the mind' (see Baddeley, 2010 for a review). WM enables individuals to retain information, beyond any perceptual cue, and work with, update, or otherwise manipulate that information. A typical example

of WM (applied in mathematics, for example) is keeping a formula in mind, while using that formula to solve a problem. The point is not necessarily to commit the formula to memory, but instead to use and manipulate that information.

Baddeley (2010) posits WM to be comprised of three main components: the central executive, the articulatory loop, and the visual-spatial scratch pad (see Figure 2). The articulatory loop and visual-spatial scratch pad process auditory and visual information respectively; however, the central executive is the main architect and the 'cognitive space' in which WM takes place (Baddeley, 2010; Caplan & Waters, 1999). The interaction of these three components (and their respective cognitive resource demand) have been shown in a variety of empirical studies (e.g., Meyer et al., 2010; Robbins et al., 1996; Vandierendonck et al., 2004). For instance, Robbins et al (1996) asked participants to select chess moves while performing one of three additional tasks (i.e., to engage one of the WM components). Experimental groups were instructed to either: 1) generate random numbers (central executive engagement), 2) press flashing keys (visuo-spatial sketchpad engagement), or 3) rapidly repeat a word (phonological loop engagement). The quality of the chess moves was highest for the third group (and comparable between the other two groups); the phonological loop is the only component not required to formulate chess moves.

Notably, move quality showed equivalent impairment (i.e., in line with increasing resource demand) across all conditions, suggesting similar effects on WM regardless of underlying individual differences (e.g., chess expertise). This breadth of impact on performance is echoed in the range of contexts to which phenomena can be applied. These include mathematics, problem solving, creativity, and reasoning (Baddeley, 2010; Miyake et al., 2000); diverse in terms of their meaning to/use by the individual, but similar in their cognitive complexity and requirement for flexibility. Thus, WM allows an individual to consider information and parse out the connection with other known things (Diamond, 2013).

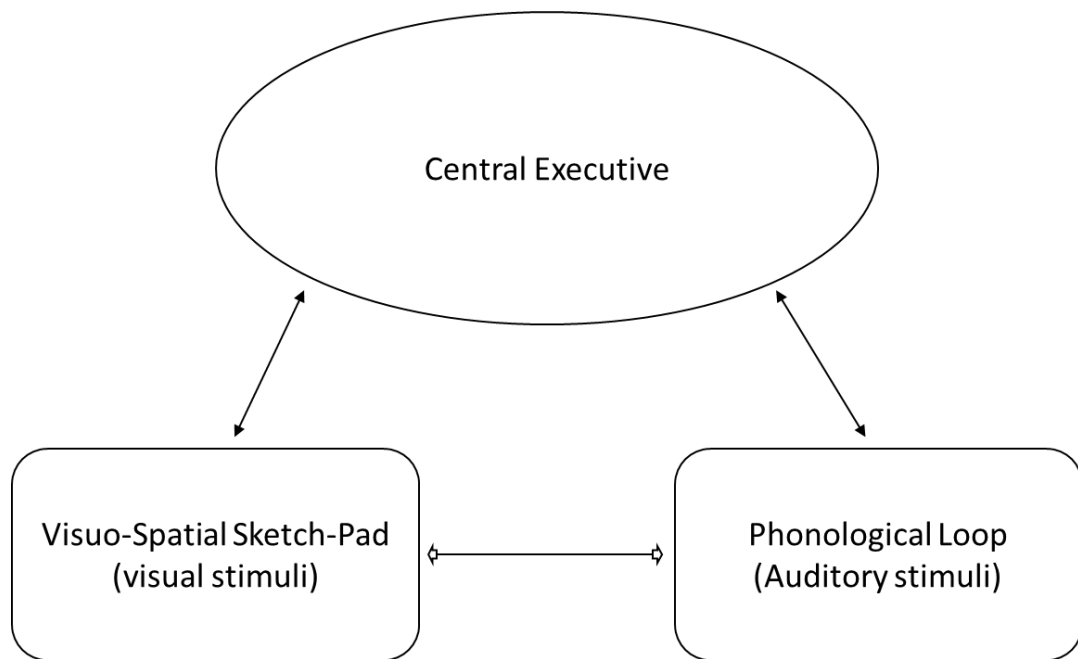


Figure 2. Diagram of the multicomponent WM model adapted from Baddeley (2010)

As with IC, development of the WM research has prompted the emergence of a number of paradigms, which have become characteristically linked to the construct. For example, these types of WM measures comprise visuo-spatial reasoning tasks, such as the Corsi Block task (Kessels et al., 2000) in which participants have to copy the order of a series of blocks being touched by the experimenter (see Figure 3).

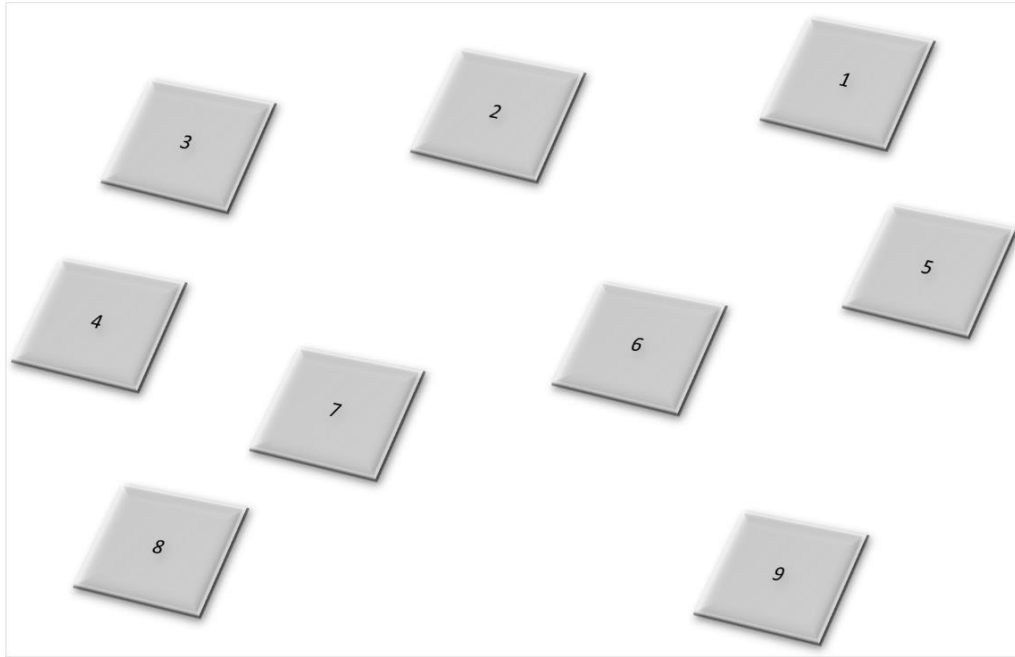


Figure 3. A typical Corsi-block task adapted from Kessels et al (2000). Blocks are tapped in ascending numerical order

Task Switching

In many models of EF (e.g., Miyake et al, 2000), task switching (TS) can also be considered core, although notably this is not the case for the Diamond (2014) model. Even in its simplest form, TS involves all three of the Miyake et al. functions (2000; i.e., monitoring, updating, shifting), as it comprises the effortful shift of cognitive resources from one cognitive task to another, following some kind of ongoing scrutiny process (i.e., to evaluate when the shift needs to be made). However, whatever consensus there is as to what the TS processing entails (e.g., Monsell, 2003) similar levels of theoretical debate exist within the literature as with other EFs, and it is important to acknowledge that this discussion is beyond the remit of this chapter.

In practical terms, when individuals perform specific tasks, they have an a priori understanding of the necessary procedural operations (i.e., a cognitive task-set). Thus, while there may be several behavioural options, the individual intentionally implements the appropriate task set (Monsell, 2003), potentially involving a shift of cognitive resources from one set to another. For example,

when a phone rings, I can allocate resources to this set and answer the call (i.e., switch to task set 2), but I could also inhibit attention to the sound and continue with my current task (task set 1). Each of these alternative responses are triggered by external stimuli (here, the phone ringing).

Individual differences have been associated with TS abilities in several studies. For example, video game experience was linked to improved performance on a TS paradigm (Strobach et al., 2012). Moreover, non-experienced video gamers also improved in TS performance after video game practice. Here, the authors linked video games as mimicking the 'real-world' applications of EF such as TS. Similarly, TS training has been found to improve the switch-cost detailed above (Karch & Kray, 2009). Building on this research, Pereg et al (2013) posited a connection with WM, and concluded that a central EF mechanism (connecting both TS and WM) was actually improved, rather than TS itself. TS has also been studied across the lifespan, and both younger children and older adults incurred larger switch costs than the average participant (Cepeda et al., 2001). Moreover, it was found that all participants switch costs improved with practice, and that older adults/younger children particularly benefited from increased preparation time (i.e., performance increase when responses were cued).

Paradigms that use task-switching (e.g., continuous alternation tasks; see Gopher et al, 2000) typically require participants to shift between two or more different behavioural responses, deliberately pivoting away from the initial task-set, orientating to another and thereby employing CF. For example, the figure matching task (Ellefsen et al, 2006; Ellefsen et al, 2017) requires participants to switch response to a target (i.e., sort by shape or colour) when instructed. Switches occurred using an alternating runs design (Rogers & Monsell, 1995), meaning participants either had to repeat the behavioural response of the previous trial, or switch to the alternative.

Connecting the Core Functions. Diamond (2013) highlights a debate regarding just how separate WM and IC are, positing a central mechanism rather

than individual functioning constructs. Moreover, evidence continues to highlight the interconnectedness of EF (i.e., WM improved with TS training; Pereg et al, 2013). Evidence for a potential central mechanism derives from the difficulty in parsing out and testing each component individually in research (e.g., see Liv, 2015). Regardless of the debate, IC supports WM by preventing an individual from being overloaded (Duncan et al., 2008); an excess of information can flood the WM (as in the chess example above; Robbins et al, 1996) and IC may prevent this. The supportive relationship between the core EF's is also demonstrated by their ability to feed into, and enable higher order functions, as detailed below.

Other Higher Order Cognitive Functions

As highlighted in Figure 1, these higher order aspects of EF (e.g., executive attention, fluid intelligence) are built from the core functions discussed above. These higher functions are typically considered as goal-directed (i.e., planning, reasoning, adapting; Collins & Koechlin, 2012; Schmidt, 2003), enabling more agency, and deliberate choices (Diamond, 2013).

Executive Attention (EA). Also referred to as metacognition, is a mediator, or monitor of lower cognitive functions (e.g., sensory/perceptual processes; Fernandez-Duque et al., 2000). Further, while EA can be included in models of EF (as in Figure 1 above), it can also be considered a component of other higher order functions (e.g., knowing what stimuli to attend). The divergence in specifying a definition EA is reflected in the variety of descriptors used in relation to this function (or those that demonstrate considerable overlap in their operation). For example, EA may operate alongside IC (e.g., Theeuwes, 2010) by highlighting what needs to be inhibited, or metacognition (e.g., Fernandez-Duque et al., 2000) by spotlighting what else an individual should be aware of.

Taken as a whole, EA can be considered akin to top-down regulation of attention (i.e., endogenous control of attention; Diamond, 2013; Rogers & Monsell, 1995). Simply put, EA may orient conscious awareness towards stimuli,

where internalized goals, expectations and previous experience drive the process. This is in contrast to exogenous attention in which attention is drawn automatically to a given stimulus, largely due to its inherent sensory features (e.g., luminance, colour, onset etc; Theeuwes, 2010). Further, EA has been indicated as the supervisory component of WM, managing its overall capacity (i.e., by maintaining attentional control of the processing; Engle, 2002).

In summary, EA appears to enable processing of lower-order cognitive input necessary for higher-order function, allowing an individual to focus on the resource demands of novel and complex tasks (e.g., problem solving and decision making; Fernandez-Duque et al., 2000). In relation to non-cognitive behaviour, EA can also play a role in aspects of 'self-control' mechanisms mentioned above (i.e., IC). For example, EA can facilitate the response regulation and moderation pertinent in conflict situations (Holmboe & Johnson, 2005). In other words, by controlling access to emotional thoughts and behavioural impulses, inappropriate and socially-undesirable responses can be avoided (Rueda et al., 2012).

Fluid Intelligence. The intelligence literature is vast, closely mirroring the contemporary societal norms and priorities through psychology's development as a scientific endeavour (Au et al, 2015). It can also be a hugely inflammatory topic (e.g., 'The Bell Curve'; Herrnstein & Murray 1994), tapping into prejudices and practices (see Hall, 2002 for a review of its continued impact on scientific processes). Even when potentially harmful opinions and values are constrained, the way we define and categorise individuals by intelligence can have considerable impact on almost every other aspect of their lives (e.g., education, occupation, social capital, self-development opportunities etc). Despite the relevance of intelligence to the topic of this chapter (i.e., cognitive ability, or speed of processing is associated with intelligence; Kail, 2000), and its traditional inclusion in Individual Differences curricula, intelligence is specifically relevant to this discussion in its fluid form (see e.g., Cattell, 1963; or Schweizer & Koch, 2002 for a more recent review).

Fluid intelligence relates to an individual's ability to recognise patterns, reason, and solve problems (see Au et al., 2015 for a review), and particularly in relation to novel situations (i.e., without prior experience/ context to help). Beyond theory, fluid intelligence has also been found to be related to enhanced academic achievement and is considered to be a highly heritable trait (Hayes et al., 2015). Further, fluid intelligence has been found to be highly correlated with EFs (Roca et al., 2010), and especially WM, given the shared imperative of maintaining information as well as monitoring it for relevance, before completion of task processing/performance (Kane et al., 2005). Jaeggi et al (2008) showed that general EF training related to improvements in fluid intelligence, and in turn, increased training led to increased improvements. However, although implications of this study were interesting (i.e., suggesting a deeper interconnectivity between higher order cognitive processes), the findings were controversial (Hayes et al., 2015), with little success in replication.

Divergent Thinking. This aspect of higher-order cognition may possibly be the phenomenon most readily recognized by the general public, and outside the scientific domain. Proclaimed to be one of the key competencies of the 21st century, due to its increasing cultural value in rapidly-changing societies (Ritter and Mostert, 2017), divergent thinking can be considered as the ability to generate novel ideas. In turn, this has particular focus on the originality and usefulness of those ideas (Ritter and Ferguson, 2017).

Most frequently, divergent thinking is applied in situations that typically require creativity, and is therefore considered an indicator of creativity (Runco and Asar, 2012). Indeed, research has identified divergent thinking as having unique effects on creative problem solving (i.e., better quality, more original) that cannot otherwise be attributed to intelligence or expertise (Vincent et al., 2002). More recently Silvia et al (2008) used an alternative method of assessing divergent thinking. Rather than using frequency of responses to indicate uniqueness, they instead asked participants to nominate their own most creative response after the divergent thinking task. Interestingly, Silvia et al also found

evidence to connect the level of divergent thinking with ‘higher-order’ individual differences (e.g., in their terminology, ‘plasticity’).

Finally, divergent thinking is highly correlated with the other aspects of cognition described above (e.g., fluid intelligence; Benedek et al., 2014). This relationship is also reflected in the overlap between measures of divergent thinking and CF tasks (e.g., fluency tasks, Guilford et al, 1978; see below). Bringing these aspects of higher order cognitive functions together, paired with the EFs outlined above, the range and interconnectedness of CF mechanisms is abundantly clear.

Where Does This Leave Our Understanding Of CF: An Umbrella Term?

While these aspects of higher cognitive abilities are clearly not an exhaustive list, they enable more ‘expansive’ abstract processing and, less ‘prescriptive’ cognition. Thinking specifically about EFs, their interconnectedness (and overlapping concepts directly linked with CF) are apparent, with common themes (i.e., adaptive function, novel and complex reasoning etc.,) evident throughout the theoretical framework. However, as outlined above, the aim here is not to provide systematic review of EF literature, but rather to explore the breadth of work overlapping with our ideas of what CF represents. Therefore, despite the evident depth and breadth of work on EF, from this point, CF will be used as an umbrella term to reflect these sophisticated mechanisms and phenomena that indicate adaptive cognition.

Regardless of the precise structure of CF, or its relation to specific neuro-architecture, the literature, as a whole, highlights a number of the debates in working in such a broad and complex field. This is also reflected in the methods through which CF is assessed and measured. Below, several examples of CF research will be explored, reviewing in particular their application to factors such as wellbeing, mindfulness, and social flexibility (i.e., coping with, and adapting to changes in social environments Muyan-Yilik & Demir, 2019). In addition, some common measures of CF will be reviewed, in order to establish how these may fit with the research needs of this thesis’ empirical work.

A Pragmatic View of CF: Behaviour, Measures, and Applications

Behaviour Associated with CF

Other than its conceptual interconnectedness with higher order cognition, CF has also been linked with a range of other constructs and behaviours. For example, Koesten et al. (2009) investigated CF as a mediating factor in wellbeing for young adults, with higher CF indicating more effective communication methods. Specifically, in more expressive families (i.e., an environment actively cultivating expression/openness), young adults were more likely to have higher levels of CF; environments characterized by conflict avoidance and expression suppression negative predicted CF levels. In turn, this was suggested to arise from affirming and flexible communication, where competing ideas and explanations were promoted. In addition, the authors suggested that CF flourishes in such environments, as individuals learn improved stress coping, management of multiple stimuli, improved perspective-taking, creating a cyclical process feeding back into enhanced CF and wellbeing (or at least, indicating a reciprocal dynamic between these factors).

CF has also been linked more directly into wellbeing facilitation, specifically mindfulness and meditation practices. In a Stroop task, Moore and Malinoswki (2009) compared between groups of experienced and inexperienced meditators. Here, CF was related positively to meditation experience; participants familiar with meditation were able to inhibit incorrect Stroop task responses more effectively, maintaining focus of attention over a longer period of time. Similarly, CF was positively associated with self-compassion, and negatively associated with dogmatism (i.e., a lack of open-mindedness; Martin et al., 2011). In fact, from the perspective of a lay person, a connection between CF and mindfulness might be asserted. CF may be understood as active, deliberate cognition (i.e., not impulsive behaviour), in turn, mindfulness seeks to minimise impact of distractions in a self-aware, purposeful manner.

Beyond effortful and deliberate actions (e.g., meditation), enhanced CF has also been explored in relation to socially-flexible behaviour (i.e., coping with

and regulating ones social environment, and interactions). A recent study (Muyan-Yilik & Demir, 2019) investigated coping strategies (together with CF and dispositional hope), aiming to understand how these factors influence wellbeing. Contrary to previous research (e.g., Martin et al., 2011), there was no support for relationships between either CF or coping and wellbeing. However dispositional hope, stress avoidance (cf Koesten et al., 2009), and social support-seeking traits (e.g., finding another to help with distress or stress) did predict wellbeing. These contradictory findings may be attributable to limitations in the study design; all traits were measured by questionnaires only, and therefore subject to typical limitations of self-report (e.g., social desirability). Similarly, Yu and Lee (2017) found a complex relationship between baseline participant hopelessness and CF. Specifically, hopelessness was negatively associated with CF, although this association disappears when hopelessness is at a low level.

Conversely, a number of classic cognition studies have highlighted that CF may incur behavioural/performance costs. For example, Rogers and Monsell (1995) showed a reliable ability to switch between cognitive tasks (switching between responding to numbers or letters; see *Task Switching* above) in their participants, but at a cost to response latency and accuracy (often combined to create an efficiency score; see e.g., Ellefson et al, 2006). Additionally, they specify that while participants were able to manage both cognitive tasks effectively, the cost was incurred only when they were required to switch. Thus, it is the act of task-switching that causes the cost, not the cognitive activity *per se*.

Interestingly, this cost was mitigated to some extent when participants were able to prepare for the switch, highlighting a possibility to 'manipulate' (or improve) performance with improved CF (Monsell, 2003) via training or naturally occurring individual difference.

Traditional Measures of CF

As is hopefully clear by this stage, CF as a concept has been investigated in a broad range of fields. Therefore, by extension, a 'bank' of paradigms and procedures have been developed to measure CF, most typically with a view to

measuring impaired or lower CF (in individual difference or neuropsychological contexts; e.g., The Wisconsin Card Sorting Task).

Behavioural Tasks. The Trail Making Test (TMT; Army Individual Test Battery, 1944, for a review see e.g., Kortte et al., 2002; Sánchez-Cubillo et al., 2009) is a visual attention and task switching test designed to measure CF. Generally used as a neuropsychological assessment of brain damage, the task involves two parts. Part A requires participants to connect a series of circles numbered 1-25 in ascending numerical order, while part B incorporates letters (e.g., 1-A-2-B-3-C etc.,) and is used as the more direct measure of CF (see *Figure 4* below). Specifically, a participant indicates lower levels of CF if they perform worse on Part B, as they are unable to switch between differing target types (i.e., cognitive sets, See Task Switching Section). Performance is evaluated via task completion (i.e., Part B, mean performance = 75s for ‘normal’ participants, and > 273s for cognitively impaired participants). However, the TMT has been criticised for the lack of precision on its construct validity (Sánchez-Cubillo et al., 2009), with evidence to suggest that Part B measures WM more closely (i.e., manipulating information in mind).

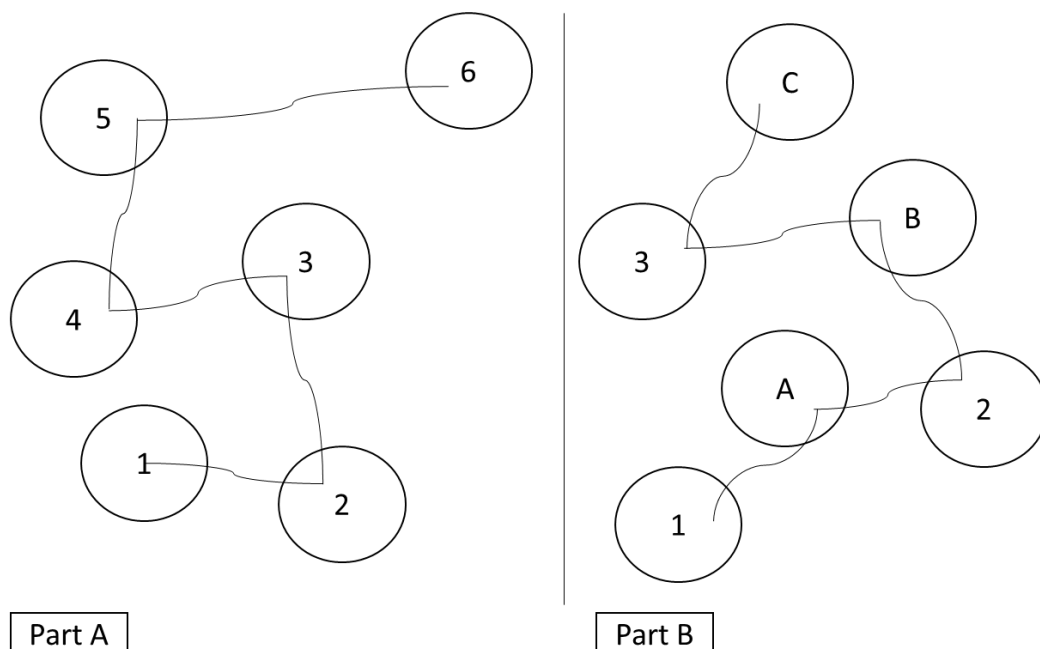


Figure 4. Simplified example of part A and B of the TMT

The Wisconsin Card Sorting Task (WCST; Grant & Berg, 1948) assesses CF in task switching (for reviews see e.g., Monchi et al., 2001; Nyhus & Barceló, 2009). Echoing TMT, the WCST was developed to assess cognitive deficit (typically as a result of brain damage). The task requires participants to match cards based on colour, shape, or number to reference cards, to establish the 'correct rules' of how the cards are classified (i.e., these are not made explicit). Participants receive feedback after each trial (i.e., if they have used the correct classification), and the classification rule is also changed after ten trials. Thus, CF is measured by a participants' ability to identify the classification rule, and adapt (or 'set-shift') when the rule is changed. Scores are based on total number of errors, with sub-categories of perseveration (i.e., applying incorrect classification error), and non-perseveration errors (e.g., genuine mistakes). The WCST is used specifically to assess prefrontal brain function, with some debate about its specificity to this region (e.g., Nyhus & Barceló, 2009). Taken as a whole, this reinforces the role of the WCST as a neuropsychological tool, rather than a technical assessment of CF per se.

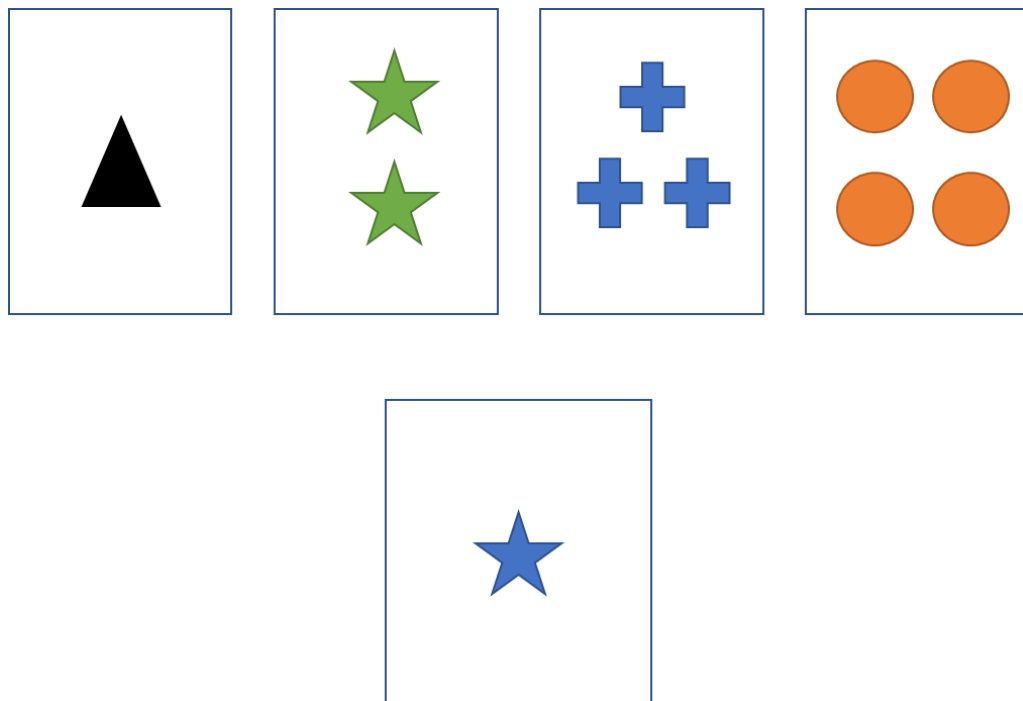


Figure 5. Example of a WCST trial, adapted from Monchi et al, (2001). The 'test card' (one blue star) has three potential matches: Number (black triangle), Shape (green stars), and Colour (blue crosses)

Gonzalez et al., (2013) built on TMT, WCST, and Figueroa & Youmans' 2012 'clock task' (designed to assess vigilance)⁶, in order to address some of the limitations of previous measures (e.g., simple dependent variables limiting the scope of the application). The puzzle task developed by Gonzalez et al. required participants to 'move' through a grid of tiles, each containing a figure with a specific colour, shape, and background colour. As with the WCST, participants needed to match their next choice with an undisclosed 'rule' (i.e., shape, background colour, shape colour). Similarly, the rule (i.e., to identify the correct choice) changed at random intervals. Participants were provided with practice trials before completing the task. Gonzalez et al. found that this measure correlated strongly with TMT performance, although not with self-report measures of CF (e.g., Cognitive Flexibility Scale; see *CF Questionnaires* below). Thus, the puzzle task was asserted to be an effective way to assess individual differences in CF, specifically in context of its application to human-computer interaction (HCI; e.g., how people interface with computers).

The inception of the tasks above were developed for application in clinical settings, with the intention of identifying CF impairment (e.g., perseveration). Intuitively, this may indicate that well-established CF measures may not adequately gauge increase in CF, especially when considering enhancement beyond baseline/ typical CF performance. For example, evaluation of the tasks outlined above and their basis in neuropsychology research (e.g., Sánchez-Cubillo et al., 2009), suggests they may be grounded more in perseverance function than CF per se (Gonzalez et al., 2013). Ongoing perseveration (i.e., when stimuli *should* provoke a change in behaviour) has been connected with specific CF deficit; indeed, CF and perseveration could be considered antithetical (Youmans et al., 2011). However, measures that more intuitively allow for assessment of enhanced CF (e.g., questionnaires) do not typically correlate with traditional behavioural measures (Gonzalez et al., 2013). That said, self-response questionnaires (e.g., Cognitive Flexibility Scale) may take

⁶ A real-world application of CF which requires an individual to flexibility balanced sustained and divided attention.

account of the more positive effects of CF (i.e., problem solving, decision making, creativity).

CF Questionnaires. Generally, CF questionnaires are broader and provide a more general insight into related behaviour (i.e., communication flexibility and attribution style; see e.g., Martin & Rubin, 1995; Peterson et al., 1982), asking participants to self-identify CF related traits (e.g., creativity, adapting to new situations). The Cognitive Flexibility Scale (CFS; Martin & Rubin, 1995) was designed for determining levels of CF, measuring an individual's awareness and willingness to adapt in any given situation, as well as their underlying self-efficacy in that flexibility. The scale has 12 items (e.g., *"I can communicate an idea in many different ways"*, *"I am willing to work at creative solutions to problems"*), measured on a 6-point likert scale (1: strongly disagree, 6: strongly agree). Moreover, this questionnaire is considered a reliable, well-validated measure of CF (i.e., a test-retest score of $r = .83$; see e.g., Martin & Anderson, 1998). The CFS showed a positive relationship between self-report and friendship-rating, in addition to more general positive association with effective communication skills. That said, CFS has limited application due to its communication contextualization, and focus on the participants' willingness to be flexible in interactions. Consequently, the CFS has equally limited value for our understanding of CF and its behavioural and cognitive implications.

With these limitations in mind, Dennis and Vander Wal (2010) developed the Cognitive Flexibility Inventory (CFI) to comprise three distinct CF components; 1) perception of difficult situations as controllable, 2) the ability to parse different reasons for behaviours and life events, and 3) the ability to consider different solutions to problems. A strength of the measure is its focus on the more typical aspects of CF (e.g., adapting and when presented with changing information). The questionnaire is also slightly more detailed, with 20 items (e.g., *"I consider multiple options before making a decision"*, *"I am capable of overcoming difficulties in life that I face"*) measured using a 7-point likert scale (1: strongly disagree, 7: strongly agree).

However, the CFI was also designed and validated within clinical populations (e.g., people with depression), echoing other established measures of CF above (e.g., WCST; Grant & Berg, 1948; see Nyhus & Barceló et al, 2001). Specifically, these focus on application of impaired CF. Further, both the CFS, and CFI are limited (as all self-report questionnaires are by design) in capturing actual human behaviour, rather than an idealised attribute (i.e., the items are intuitively socially desirable; e.g., *"I am capable of overcoming the difficulties in life that I face"*).

Following the literature, the overarching difficulty in defining CF is clear and it follows that isolating the behaviour or attributes in question would also be difficult. As it stands, these questionnaires present an idealised, non-specific version of CF which is socially desirable (e.g., *"I often look at a situation from different view points"*; Dennis & Vander Wal, 2010). This lack of specificity might even be considered an advantage of a questionnaire, enabling the questionnaire to be more accessible to more people. Nevertheless, this also limits their scope in capturing CF 'in action' (i.e., in what situations does an individual consider different viewpoints, or what difficulties are they capable of overcoming? etc.). Therefore, behavioural paradigms (whether laboratory or real-world based) may be a more effective and ecologically sounds way of measuring CF.

CF in 'The Real World'. As alluded to above, CF can be observed beyond specified measures. For example, CF can be studied by using 'indirect' tasks that require cognitive flexibility for successful performance, such as the Stroop task (Stroop, 1935; see e.g., Moore and Malinoswki, 2009). This, and similar tasks are an effective measure for CF as they impose a distinction between automatic-controlled behaviour (MacLeod, 1992); in other words, an individual has to suppress an automatic response in favour of a controlled, intentional one, within conscious awareness. However, this does not ensure that the task can measure CF without the 'contamination' of other real-world factors.

For example, Phillips et al (2002) assessed the relationship between positive mood and CF, using both Stroop and fluency tasks, in this case three

versions were used, e.g., 1) listing as many words that begin a specific letter, 2) naming alternative uses for a specific item, and 3) alternating between naming items belonging to phonetic and semantic categories (see *Chapter 3*). In part, the methodology was designed to avoid the negative affect sometimes associated with CF tasks such as the WCST (Grand & Berg, 1948; e.g., frustration and distress). Phillips et al. found that positive mood actually impaired Stroop task performance, but, in contrast enhanced performance on the creative fluency task.

While paradigms like the Stroop task are useful for observing aspects of CF in specific cognitive domains (i.e., here, attention), other paradigms are more explicitly related to the theoretical concepts explored above, such as task-switching (see *Task switching* above; or Monsell, 2003 for a review). An example of a task-switching paradigm employing CF are alternating-runs style tasks (Rogers & Monsell, 1995), where participants have to switch between two task-sets at specific intervals. By using an alternating runs paradigm, one can explore how efficiently a participant is able to switch, thereby determining how flexible they are. Olfers and Band (2018) identified a connection between CF and increased performance (i.e., faster RTs) on an alternating-runs task, specifically indicating less impact of distracting items. Here, the advantage of using behavioural paradigms (e.g., task-switching) as an indirect measure of CF is more clear; findings are more reflective of CF in the ‘real-world’. Moreover, this allows insight into the impact of individual differences on CF, such as targeting specific populations potentially demonstrating more CF (e.g., video gamers; see Olfers & Band, 2018; Colzato, 2010). Thus, the behaviour and abilities attributed to CF are not abstract ideas, but instead have an everyday application connected with enhanced ability.

Further, by avoiding explicit orientation to CF and CF-related behaviour (e.g., in questionnaires; see Phillips et al., 2002; above), researchers can avoid incidental/inadvertent prompting participants into inauthentic CF, especially where their objective is to understand CF *in action*. Finally, if the research goal is understanding how CF can be modified by specific circumstances, ‘reverse

engineering' a paradigm (i.e., starting with the behaviour, rather than the abstract measure) may reveal a more ecologically valid behaviour. In particular, this would allow for increased granulation in CF measurement, situated in applied contexts, without the subjective bias that often accompanies questionnaires (i.e., demand characteristics; Orne, 1962; Nichols & Maner, 2008).

What Do We Know About CF Now?

Taking this information into account, it seems fair to conclude that the title *CF* emphasizes its most characteristic component, *flexibility*. We have seen that CF encompasses a vast range of cognitive, behavioural, theoretical and pragmatic issues- and that the literature reflects this. Moreover, CF as a research arena is evolving, with competing views of its application and definition (e.g., Diamond, 2014; Cañas et al., 2003; Braem & Egner, 2018). However, while debate persists in the wider literature concerning conceptualization of CF (e.g., domain specific versus domain general), for the purpose of this thesis we can arrive at a clear way forward for the empirical work to follow.

In light of the contents of this chapter, the importance of arriving at a clear working definition of how this thesis will conceptualize CF is overwhelming. Here, I will focus on CF in its everyday function; as the capability of an individual to think and behave adaptively in different environments. This definition has the most intuitive connection with BBH and T-AR (Fredrickson, 2001; see *Chapter 1*). Additionally, this builds on the most widely-accepted understanding of CF (e.g., Diamond, 2014), and moves away from literature focused on functional deficit (i.e., WCST, Grant & Berg, 1948), or CF as an idealised characteristic (i.e., CFI; Dennis & Vander Wal, 2010). Finally, and possibly most important for the empirical work to follow, this definition also allows for our understanding of CF to be enhanced through novel applications.

In addition to extending understanding of T-AR, this evaluation of CF literature and measurement provides a useful opportunity to explore practical applications of enhanced CF. Much previous research (e.g., Muyan-Yilik & Demir,

2019; Yu & Lee, 2017; Koesten et al, 2009; Figueroa & Youmans, 2012) has relied on these well-established measures, often within clinical populations, without consideration of ecological validity or generalizability. Therefore, by using paradigms not typically associated with CF, but which indirectly employ behaviour we recognise as CF (i.e., exploring the literature detailed in this chapter), we have a chance to add to that literature as well as our primary focus of this thesis (i.e., the impact of positive individual differences on cognitive abilities/CF).

Overlapping Psychological Theories

As established above, one of the primary aims of this thesis is to explore the potential extension of BBH (Fredrickson, 2001) to CF. After a thorough exploration of each concept (i.e., BBH in Chapter 1, and CF, here), it is readily apparent that overlap exists between these distinct psychological approaches. Therefore, for the remainder of this thesis, an overarching aim will be to support convergence of these concepts, through both empirical evidence and theoretical discussion. This is exemplified by the definition used here for CF (see *What do we know about CF now?*), chosen partly because it is complementary to BBH, and because it allows these fields to be brought together. To this end, Chapter 3 will explore the methodological and practical choices made in order to fulfil this overarching aim.

Chapter 3: Bringing Hope and Cognitive Flexibility Together: Methodological Issues for this Thesis

In Chapter 1, character strengths generally, and hope, more specifically, have been linked with numerous positive behavioural and cognitive factors (e.g., coping with stress, decision making); arguably, these can be suggested to indicate high levels of behavioural adaptivity (i.e., thought-action repertoire). Positive Psychology (PP) frameworks have fostered development of theories (e.g., BBH; Fredrickson, 2001), which enable us to make the case for behavioural adaptivity more strongly. In Chapter 2, Cognitive Flexibility (CF) was explored as a construct, linking the cognitive functions normally discussed alongside BBH (e.g., attention, memory), with higher order processing, such as executive functions (EF). Finally, I identified potential overlaps between the operation of BBH and cognitive mechanisms included under the conceptual CF ‘umbrella’. While cognitive functions typically linked to BBH in the literature do not align perfectly with higher-order functions (i.e., ‘CF-type’ processing; see above), that is not to say they are not relevant. In fact, this point highlights one of the key aims of this project.

In this chapter I will outline the most important methodological approaches that will be used to explore the aims of this thesis. First, an overview of mixed methods (MM) research will be provided, detailing the rationale for its application in this inquiry. This is followed by a summary of the specific methodology and paradigms used in subsequent studies, providing a ‘road map’ for the commonalities across the empirical chapters to follow.

Mixed Methods (MM) Research

The concept of convergence (i.e., bringing together distinct phenomena to better understanding human behaviour) has been highlighted as a fundamental driver for this research; naturally, this will be reflected in any methodology adopted. MM designs employ a mix of qualitative- and quantitative-related techniques (e.g., viewpoints and perspectives, data collection and analysis techniques; Johnson et al., 2007) in order to obtain the

optimal understanding of the behaviour in question. Notably, MM is not only a flexible, able-to-be-tailored methodology, but also reflects an epistemological perspective to enable holistic understanding and corroboration of phenomena (Creswell & Plano Clark, 2017). Thus, the concept of integration is considered a hallmark of MM research (Creswell & Plano Clark, 2017; Johnson et al., 2007; Östlund et al., 2011); the goal is not to collect two different types of data related to the same phenomena, but instead to assimilate these (via data collection, analysis, and/or interpretation) in order to have a more complete understanding. In other words, while data reflect traditional qualitative and quantitative characteristics (e.g., words and numbers), these need to be carefully integrated (e.g., mixed or combined), rather than keeping data (and subsequent findings) separate (Bryman, 2007).

Why Use a MM Approach?

According to Creswell and Plano Clark (2017), there are a number of scenarios which are particularly well suited to MM designs. Firstly, one might need to corroborate results to provide a more complete understanding of a phenomena, which cannot be done through the use of qualitative or quantitative methods alone. For example, a singular method may not provide sufficient insight into the issue under review, or the data generated may be limited. Secondly, one may need to explain results of an initial study in more depth (typically, in the case of quantitative data); here, use of qualitative data will enable a more applied understanding of what a set of statistical results mean in the real world. Conversely, a research question may require a more dispersed initial focus. In this case, using qualitative methods to gain a more general understanding will enable the researcher to gain insight into the types of quantitative measures best suited for more in-depth investigation. The quantitative data can then supplement initial qualitative findings and facilitate generalization of results.

In terms of common applications, MM designs are able to describe and compare different groups particularly effectively. In this instance, quantitative

measures can provide the measurable objective differences between groups, while qualitative data can 'translate' these differences into real world meaning. This latter point is particularly relevant to aspects of my work, since MM approaches are useful in evaluating interventions, assessing effectiveness (i.e., does the intervention have the intended effect?), as well as exploring participants' subjective experience of the intervention and its viability (and suitability) for use beyond the work in question.

Regardless of any technical rationale for using MM approaches, intuitively while a single-focus approach may yield relevant findings, use of multiple foci suggests a more comprehensive understanding is likely to be achieved. This idea may appear critical of single method approaches, but instead emphasizes a situational need for approaches to be integrated (i.e., to ensure data are corroborative and lead to a more complete understanding). According to the methodological literature (e.g., Creswell and Plano Clark, 2017), there are no 'rules' which determine the scope or extent of qualitative or quantitative elements within any specific study, but rather this is represented by a continuum, on which research is located, depending on pragmatism and technical requirements (see Figure 6 below).

Creswell and Plano Clark (2017; see also Morse, 2003; Plano Clark, 2005; Nastasi et al, 2007) have suggested a mnemonic using capital/lower case letters to signify the balance of qualitative and quantitative strands in a study. For example, QUAN + QUAL indicates equal emphasis on each strand of the research, whereas QUAN + qual indicates a quantitative focus supplemented with qualitative elements.

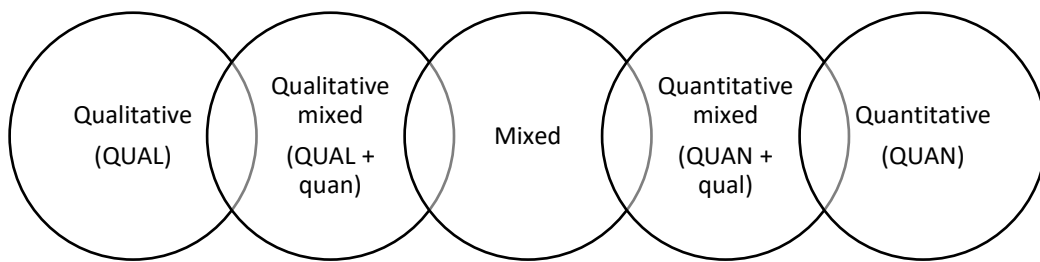


Figure 6. The spectrum of mixed methods research, from qualitative-dominant to quantitative- dominant, adapted from Johnson et al (2007)

Types of MM Methodologies

Broadly, there are three core methodological designs utilised in MM research: convergent, explanatory sequential, and exploratory sequential (Creswell & Plano Clark, 2017)⁷. One advantage of MM research is avoidance of the typical constraints/rigidity that might accompany single-approach designs. For example, quantitative research may ignore the role of the individual in research, not attributing value to their voice or experience (Creswell & Plano Clark, 2017), allowing for a level of pragmatism in MM research (Morgan, 2007). However, adhering to established paradigms/study designs within each ‘school’ ensures that sufficient validity and robustness is built into the methodology, and errors that might lead to confounds or poor research practice can be avoided easily. Speaking less formally, this type of design enables a researcher to obtain ‘the best of both worlds’ or to ‘have their cake and eat it’.

Convergent Designs. This is widely- held to be the most frequently used mixed methods design (Creswell & Plano Clark, 2017; see Moseholm & Feters, 2017). Here, researchers collect both qualitative and quantitative data in order to combine/compare results to gain enhanced overall understanding. The convergent design enables a reciprocal relationship between data types, allowing each to validate, confirm, and amplify the other. Characteristically, convergent

⁷ Although, as alluded to above this is not necessarily a complete list, but rather covers the ‘core’ principles in MM designs (Bryman, 2006).

approaches use a QUAN + QUAL design, although it is possible to place less emphasis on the second strand (e.g., QUAN + qual). Regardless of data strand dominance (DSD), focus is always on integration/convergence of findings. Typically, data is collected simultaneously, and analysed separately, before results from each data strand are merged. Content relevant to both data strands can be discussed (by researchers to parse out meaning) to integrate, highlight similarities, differences and/or comparisons in findings, or convert data to one format (e.g., transform qualitative data from themes into frequency).

Explanatory Designs. Generally speaking, explanatory MM designs adopt a QUAN + qual design, although it is possible to place equal emphasis on both data strands (Ivankova et al., 2006). The focus of this design type is sequential data collection. Quantitative data is usually collected first, followed by the qualitative strand- which is used to explain (or offer further insight) into quantitative findings. The explanatory design is often used to study phenomena or research questions considered better suited to quantitative data (e.g., changes in education practices; Li et al., 2015), or where the researcher has sufficient time/resources to include qualitative elements in secondary data collection. Importantly here, this approach offers an additional perspective where the qualitative strand approach (e.g., design, data analysis) can be informed by quantitative findings. While the data will still be assimilated, qualitative findings may give a unique insight not easily attainable if data are collected simultaneously. However, this can also limit the richness of qualitative data as they must be based on, or derive from a need to explain some element of the quantitative data.

Exploratory Designs. Contrary to the previous design type, exploratory designs frequently have a QUAL + quan focus, although again the two strands can be emphasised equally (Bryman, 2006; Creswell & Plano Clark, 2017). Typically, exploratory designs are sequential in nature (similarly to explanatory designs) and indicated from its name, the focus here is to *explore* a concept or

phenomena qualitatively, in order to better understand it⁸. For example, a researcher may use this approach to develop new theories or measures via qualitative findings, and subsequently, to collect more accurate quantitative data. This design can be used where previous understanding of a phenomena is limited, or if existing models and measures are not considered valid or robust. The quantitative data are then collected based on this deeper understanding, to ensure the findings can be generalized.

MM Research in Practice

MM designs have been used in a variety of research fields. Examples range from nursing and health (e.g., Östlund et al., 2011), occupational and management research (e.g., Azorin & Cameron, 2010), marketing (e.g., Harrison & Reilly, 2011), social sciences (e.g., Collins et al., 2006), and (as indicated by its use here) psychology (e.g., Powell et al., 2008)⁹.

MM designs have proven to be an effective approach within PP research. Akhtar and Boniwell (2010) explored intervention development (utilising character strengths such as optimism and gratitude) in the treatment of alcoholism. Their research emulated an exploratory design¹⁰, focusing primarily on qualitative data collected via semi-structured interviews supplemented and generalized via quantitative data (e.g., questionnaires). Interestingly, the researchers were able to validate their intervention program through the convergence of each data strand (i.e., participants both objectively improved, and enjoyed or at least could recognise the benefit of participation in the intervention, suggesting it to be a program they would continue to use).

Another example of MM research in PP is seen in Yeager et al (2012), who explored the impact of different goal motivations on long term career success and life satisfaction. In contrast to Akhtar and Boniwell (2010), Yeager et al.'s

⁸ Harrison and Reilly (2011) conducted a content analysis of 2,166 marketing journal articles where a MM approach was used and found that exploratory designs were the most common (47%).

⁹ Although, there is some suggestion (see e.g., Hanson et al., 2005) that psychology in general focuses too much on experimental or quantitative methods

¹⁰ While this is not stated by the researchers, their study most closely maps on a QUAL + quan design as per Figure 6.

design was more typical of an explanatory approach, focusing on quantitative data (primarily derived from questionnaires), and supplemented with semi-structured interviews. However, more pertinent to the studies presented in this thesis, the MM data assimilation provides further insight that might not otherwise be garnered through a single-design approach. Yeager et al (2012) identified through the qualitative data that participants were not processing goals at a deep enough level (i.e., less defined, considered less important), providing a potential explanation for the type of goals recorded in the quantitative data (which considered alone were unexpected). Here, the convergence of the data strands allowed the researchers to better understand the phenomena under investigation.

Taking as a whole (i.e., the methodological philosophy, examples from the literature), MM designs provide a robust and pragmatic framework through which the aims of the current studies can be actualised. Additionally, the overarching theme of convergence detailed throughout this chapter is matched in MM research with the emphasis on integration. Given that a rationale for an MM design has been thoroughly explored, the following sections will detail some of the more specific methodological choices (e.g., paradigm selection).

Methodological Choices and Paradigms

The overarching emphasis on ‘convergence’ and depth understanding of the behaviour examined in this work is probably already clear to the reader. However, it is also important to show how these decisions will impact on more specific choices made for each study/cluster of studies. In general terms, a convergent MM approach utilising a ‘QUAN + qual’ design has been adopted for the empirical work to follow in this thesis. While both strands have been collected simultaneously, the primary source of data (and subsequent analysis) in each study has been quantitative. In this way, qualitative data can be considered supplementary. In most cases, this has been analysed via content analysis (Hsieh & Shannon, 2005), and used to: 1) gain insight into participants’ subjective experience, and 2) offer ‘real world’ context for the laboratory studies. Reflecting

a personal scientific ‘philosophy’, this approach also ensures the value of participants’ subjective experience is acknowledged, thereby avoiding oversimplification of human behaviour, and its reduction to a point where it lacks all ecological validity (Miller, 2008).

That said, one empirical study presented as part of this thesis (i.e., a diary study; see *Chapter 8*), changes the DSD to QUAL + QUAN, mainly due to a change in research question focus. Given this was a longitudinal intervention-based study, more qualitative data collection was required. In turn, these data necessitated a change in analysis style (i.e., here, thematic analysis; Braun & Clarke, 2006). Nevertheless, the focus remained on data assimilation; the ‘success’ of the intervention was evaluated via convergence of both qualitative and quantitative data strands.

These methodological choices have affected the empirical work of this thesis. As a starting point, the laboratory studies reported in this thesis have used well-established cognitive paradigms (e.g., The Navon Task, Navon, 1981; The Adaptive Choice Task, Irons & Leber, 2016; The Alternative Uses Task; Guilford et al., 1978). By using previously validated paradigms, it becomes more straightforward to differentiate subtle behaviour elicited by novel interventions and to explore application of the BBH to character strengths (i.e., hope; Snyder et al, 1991).

This is especially relevant when subjective interpretation and expression is embedded within the qualitative aspects of this research (e.g., participants are asked to ‘sort’ their own character strengths). Even more importantly, current literature on hope-based intervention has highlighted that, when ‘successful’, such interventions are likely to elicit small, albeit statistically significant, increases in hope levels (e.g., Weis and Speridakos, 2011; see Chapter 1). Thus, it appears pertinent to select paradigms where typical findings/effects are relatively predictable, and a laboratory testing environment offers some level of control. In addition, these paradigms have been chosen due their direct or analogous links with the CF and BBH literatures. For example, The Navon Task (Navon, 1981; Fredrickson & Branigan, 2005) speaks directly to global and local

perceptual processing (see *Navon Task*), while BBH points to expanded (literally, broadened) T-AR in response to positivity.

Thus, these selections serve two purposes. The first is that their use may extend the BBH literature to demonstrate impact on higher cognitive functions (cf effects on memory/attention etc; Fredrickson & Branigan, 2005). To this end, three paradigms will be used to demonstrate the range of cognitive function that can potentially be categorized as CF (e.g., perceptual processing, optimization of visual search performance, divergent thinking tasks). Second, and more specifically, the extension of BBH to character strengths (hope, in particular), rather than positivity more generically, may require the same predictability and control as alluded to above.

Overview of Empirical Work

In total, six laboratory-based studies have been conducted to explore the effect of two character strengths interventions; 1) a Card Sorting Task (CST; see Chapter 4), and 2) a Goal Reflection Task (GRT; see Chapter 5). As mentioned above, this has involved use of three paradigms: The Navon Task (NT; Navon, 1977), The Adaptive Choice Task (ACT; Irons & Leber, 2016), and The Alternative Uses Task (AUT; Guilford et al., 1978). Each paradigm draws on cognitive function that represents CF (see *Chapter 2*). For example, the NT requires inhibition and task-switching for successful performance, whereas the AUT utilizes fluency/rapid processing and divergent thinking/creativity. However, given the differing levels of cognitive sophistication and/or control required for successful performance in each task, potentially, these may give more insight into how BBH can affect higher order cognition. The studies have been clustered by intervention, in order to reflect the parallel nature of both phases of work, and to show how the low-impact hope interventions have been developed more clearly.

Finally, a seventh empirical study will be presented, which uses a diary study format and an extended intervention (e.g., daily goal reflection). This study builds on data collected in Studies 1-6, by asking participants not only to reflect

on past achievements or strengths, but also focus on future goals. The conceptual basis of Study 7 will be outlined in Chapter 8.

Focus on The Paradigms

Navon Task (NT). This perceptual processing task (Navon, 1977, 1981) is based on the cognitive mechanism of ‘zooming in’ on stimuli (or perceptual components of stimuli), to optimize processing via attentional focus on global (general) or local (specific) features. The process indicated in Navon’s original work (i.e., an individual’s initial perception of a scene comprises little distinction between items, but is followed by focus on specific details) was illustrated by his choice of title- alluding to the folk psychology of whether humans are able to ‘see the wood for the trees’. In fact, Navon’s findings demonstrated the reverse; perception begins at the global, general level, and progresses to a local, specific level. Further, this global precedence effect typically shows that local targets are responded to slower, and less accurately (Navon, 1981), which illustrates a clear behavioural cost to narrowing the attentional focus to local targets.

Since its original inception, NTs have been used widely within the cognitive psychology literature (e.g., Prosopagnosia; Duchaine et al., 2007; cultural differences in cognitive development; Davidoff et al., 2008). Most pertinently here, Fredrickson and Branigan (2005; see also Chapter 1) adopted this paradigm as part of their work on BBH, with a clear ‘expanded attention’ effect (i.e., promoting global processing) elicited via increased positive affect. That said, recent research has highlighted how positivity can also alter these cognitive responses. For example, Noguchi and Tomoike (2016) saw faster responses to local stimuli following positive mood induction. While this contrasts with Fredrickson and Branigan’s (2005) findings, it does serve to confirm the NT as an effective measure for examining cognition in the context of PP.

An additional advantage of the NT is its responsiveness to intervention, as illustrated in both Fredrickson and colleagues’ and Noguschi and Tomike’s work above. However, in this thesis, I also need to address the introduction of higher task demands, where EF resources, such as task switching and inhibition, are

likely to be taxed (i.e., ‘alternating runs’ trials requiring a change in response type; see Rogers & Monsell, 1995). In this way, it is also possible to assert that task performance in this paradigm encompasses both simple low-level cognitions, and those functions indicative of CF. The lower-level functionality should provide an effective baseline by which intervention efficacy can be measured.

Task Overview. Typically, an NT directs participants to identify a target letter which will be present at either the global or local level; an illustration is presented in Figure 7 below. In this example the target letter ‘H’ is presented in two forms: globally (i), and locally (ii). During NT performance, a participant would typically have several targets they search for in each trial, responding as quickly but accurately as possible as soon as they have identified the targets level.

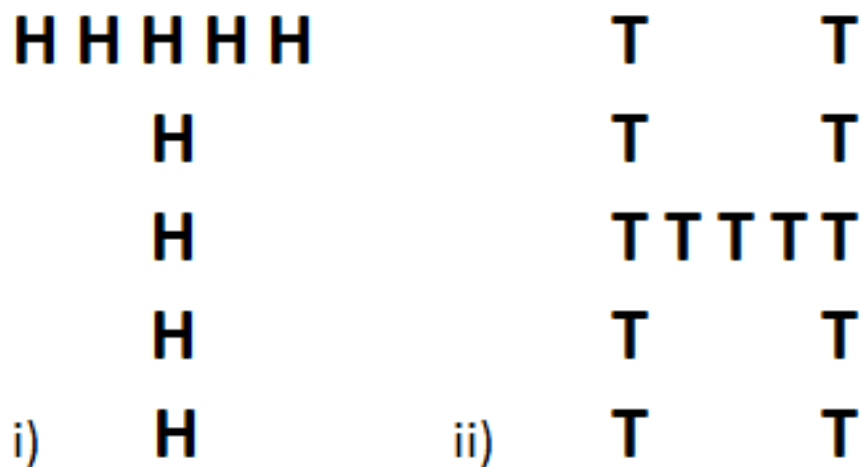


Figure 7. Example of Navon task stimuli, with global T/local H & global H/local T

The NT used in the current studies was adapted to have a higher demand on CF resources in Chapters 4 & 5 (i.e., to avoid ceiling effects, and to ensure engagement of higher order cognitive mechanisms). Therefore, in addition to the target identification, a change in response was also required (see Figure 8 below). Here, the keyboard key used to indicate a target level has been identified changed every eight trials (e.g., Figure 8: from ‘H’ to ‘J’). To increase demand on

CF resources, response changes were not tracked in the program (i.e., indicated to participants), instead participants were required to count and track when a change in response was required, swapping response-type back and forth every eight trials.

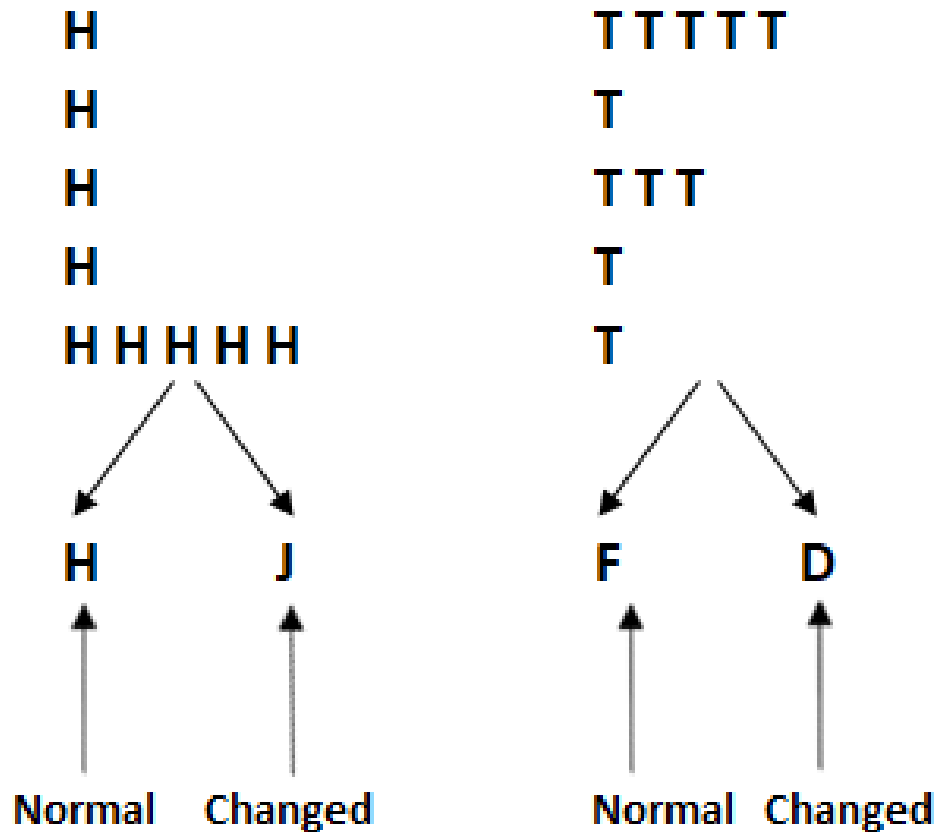


Figure 8. Example of a typical NT trial for both target letters, with the changes in response alignment

The Adaptive Choice Task (ACT). The Adaptive Choice Task (ACT; Irons and Leber, 2016, 2018) has been used to explore attentional control in dynamic visual environments. Here, participants are asked to choose between available visual search (e.g., Wolfe, 2015) targets, in arrays adapted to make one target an optimized choice (i.e., fewer distractor items of the same type). Some participants in the original study were able to navigate the changing visual field flexibly, switching targets to remain optimal in their selection. However, these results were not shown across the sample, with some participants slower at switching to optimal targets, while remaining highly accurate. Most importantly

for this project, the authors highlighted the role of individual participant differences in their subsequent study. The effort and efficacy (in switching targets) perceived by participants was found to be a predictor of their target choice optimality.

As with the NT, the ACT has not formally been used as a measure of CF previously. Nevertheless, behaviour required for effective performance reflect those characteristic of CF (i.e., dynamic, adaptive functioning within changing environments, agency in behavioural choices, etc; Diamond, 2014). Furthermore, the impact individual differences on task performance, in addition to the task's demonstration of CF-type function (e.g., task switching; Monsell, 2003) make the ACT a useful vehicle for examining the behaviour of interest here.

Task Overview. Figure 9 below is a typical ACT trial. The aim of the task is to identify a target (here, a red or blue square with a number between 2-5) from an array of distractors; red and blue squares numbered between 6-9, and green squares numbered between 2-9. Indicative of the task name, a choice is available between two correct targets (here, a red '4', and a blue '3'). The red and blue target will never be the same number within a trial (i.e., if the red target is 2, then the blue must be 3, 4, or 5). Further, distractor targets vary predictably across trials, which from a participant's perspective means that some trials will contain more red distractors, and some will contain more blue.

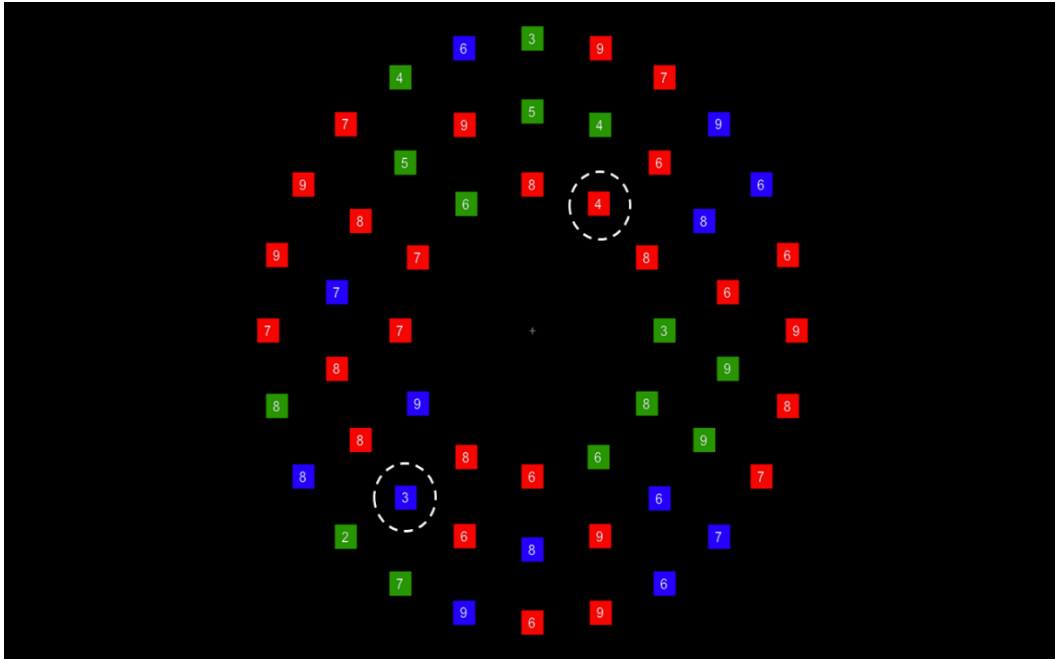


Figure 9. Typical ACT trial. Two correct target trials are outlined, participant would press 'B' for the blue target, and 'N' for the red target

Once a target has been found, participants indicate this by pressing a predetermined keyboard key (e.g., if the target is a number 3, participants press the 'B' key). Participants are instructed to respond as quickly but accurately as possible. In addition to measuring the typical RT and Accuracy, the 'choice' element of the task is measured by two variables: Optimal Switching (i.e., does the participant search for the target efficiently by searching the colour least represented), and Proportional Switch (i.e., the frequency with which participants switch targets as colour proportions change). Thus, the task enables a researcher to measure how flexibility participants are able to adapt to a changing environment.

The Alternative Uses Task (AUT). In Chapter 2, CF processing has been examined in the light of fluency-based tasks (see Diamond, 2014). The AUT (Guilford et al., 1978) requires participants to create alternative uses for household items. In turn, this signposts CF-style processing, such as fluid intelligence (see Au et al., 2015), and divergent thinking (DT; see Ritter & Mostert, 2017). In this way, the AUT provides a distinctive third additional to the tasks already outlined above. In contrast to the NT and ACT, this paradigm been

used previously to measure CF per se (see Dippo & Kudrowitz, 2013; for a review)¹¹. The AUT has frequently been used as a measure of flexible thinking across a variety of literature, in (somewhat ironically) divergent research (e.g., correlating DT with increased eye blinks, Ueda et al., 2016; computational models to ‘solve’ creative thinking; Oltețeanu & Falomir, 2016,).

Task Overview. The AUT asks participants to think of alternative (creative, or novel uses) for household items. A description for the typical use of the item is provided (e.g., the example in Figure 10 below, the description would be “*Water Bottle: used to drink water*”), and the alternative uses must be different from the original. Three household items are presented per section, and a time limit of 4 minutes is given for each section.

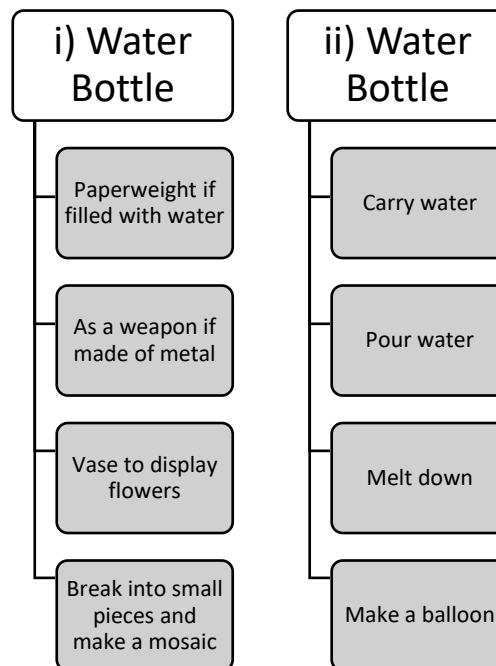


Figure 10. Diagram showing potential responses to a hypothetical AUT item. i) has four responses that are different from the original uses (to hold water), in ii) the four responses are rejected for either being too similar to the original use (e.g., carry and pour), not clear what the use is (e.g., melt), or impossible without further information (e.g., balloon)

¹¹ Dippo and Kudrowitz suggest the AUT is not a measure of creativity, but of novelty. While creative thinking is employed, the task on requires novel uses, but not necessarily that these are ‘useful’ per se.

The AUT differs in its exploration of CF from the NT and ACT, in that its focus rests clearly on creative and divergent thinking. To measure CF, while a time limit is still placed on participants, the AUT is the least temporally restrictive task; participants can choose where and for how long to focus on each item which in and of itself is demonstrable of CF (i.e., are they able to balance and deal with multiple items). Furthermore, the AUT has several outcome measures (see Chapters 4 and 7, for a full description of the AUT analysis procedure). The main outcome, Fluency, measures how many acceptable uses are generated (in Figure 10 i, four acceptable uses are listed); the alternative uses are different from the original use, and from each other. In contrast, a less successful example is demonstrated in Figure 10 ii, with four rejected suggestions.

Accuracy is calculated based on how many uses are accepted; a use may be rejected if it is too similar to the original use, or if it is nonsensical (e.g., making a balloon from a water bottle). Additionally, other factors such as Flexibility (i.e., the type of category associated with the alternative uses), Elaboration (i.e., the amount of detail included), and Originality (i.e., across the whole sample, the originality of the uses) are also measured. Take as a whole, the AUT can be considered to provide unique insight into the creative, novel thinking associated with CF.

Diary Studies. Study 7 (Chapter 8) diverges from the format used in Studies 1-6. As a 'stand-alone' study, the main body of methodological detail will be presented alongside the study itself (including the full literature review and justification of the study). This is because the study has been published (Hodson, MacCallum, Watson, & Blagrove, 2021), and preserving the peer-reviewed format of the paper as much as possible appears useful. The study itself builds on the findings of earlier studies presented above, and seeks to explore the daily goal setting, attainment, and reflection (in an adapted format of the GRT). However, to provide consistency with other empirical work presented here, a brief overview of design and methodological choices are presented in this section.

The efficacy of PP interventions, especially those based on hope (see Weis & Speridakos, 2011), have already been established in Chapter 1. Additionally, examples found in related literature demonstrate the use of diary studies in the investigation of character strength and intervention exploration (e.g., gratitude journaling; Schnitker & Richardson, 2018; hope in the workplace, Ouweneel et al, 2012). Diary studies have also been used previously in combination with MM designs (e.g., see Amabile et al, 2005), particularly because they allow for the collection of qualitative data in a more natural environment (e.g., the participants home, with no researcher present).

This is of particular interest in this thesis, as the relationship between the GRT and any subsequent changes in behaviour and/or affect will allow further insight into its efficacy and application beyond a laboratory setting. Finally, a discussion of different outcomes between the longer intervention application (i.e., the diary study) and the single session application (i.e., empirical laboratory studies) can be facilitated. Specifically, there is some debate within the goal-oriented/hope-based intervention literature (see Weis & Speridakos, 2011) about the effectiveness of single-session versus sustained inventions, and a short term diary study may allow the gap between each approach to be bridged.

Summary of Thesis Structure for Empirical Chapters (Chapters 4- 9)

Chapter 4 presents a cluster of three studies which employ the CST paradigm detailed above. Building on these findings, Chapters 5, 6, and 7 apply the GRT to the same paradigms, with the inclusion of additional measures of individual differences (i.e., hope questionnaires), plus more detailed qualitative analysis. Chapter 8 presents the application of the GRT in a diary study. Finally, Chapter 9 reviews the findings of all three types of empirical work, evaluating the interventions used, and the theoretical and practical implications of these findings, beyond the scope of this thesis.

Chapter 4: Exploring Character Strengths and Cognitive Flexibility

Character Strengths as an Intervention

By now, the overarching aim of the current research is hopefully clear. That is, to explore and extend application of BBH, specifically investigating the extent to which ‘positive’ individual differences (i.e., character strengths; Peterson & Seligman, 2004) enable the same behavioural and cognitive advantages as positive affect (see Fredrickson, 2001). It is important, at this point, to highlight that character strengths have also been associated with facilitation of the positive affect typically connected with BBH (Martínez-Martí & Ruch, 2016). However, the gap between facilitating positive affect (i.e., robustly linked to the operation of the BBH) and character strengths per se is yet to be closed convincingly.

Character strengths interventions are one way in which this research aim can be pursued. Such interventions have previously been linked to increased life-satisfaction and social skills (Proctor et al, 2011; Seligman et al, 2009; see *Chapter 1*). Importantly, these interventions typically drive participants to actively engage with their strengths, fostering recognition of the positive impact of each strength without imposing a value ‘hierarchy’ (i.e., each strength is equally valuable).

In a review, Meyers et al (2012) defined PP interventions as *intentional activities* based on: 1) cultivating positive individual experiences, 2) building positive traits, and 3) building positive institutions and *civic virtues*, with the literature ranging from personal impact (e.g., improving mood and personal resources; Cohn and Fredrickson, 2010) to more general wellbeing (e.g., Niemiec 2018¹²). Niemiec also specifies five factors by which to gauge intervention (especially character strengths intervention) efficacy: *naturalness*, *enjoyment*, *value*, *guilt avoidance* and *situation*. While naturalness (i.e., engagement ‘feels’ natural) and enjoyment (i.e., activity is enjoyable, interesting or fun) appear fairly

¹² Niemiec (2018) also notes a lack of empirical evidence to support nuanced definitions and classifications of PP and character strengths interventions.

superficial (and intuitive), the remaining factors are arguably more existentially relevant. For example, whether an intrinsic *value* is seen in the activity, regardless of outcome, may depend entirely on personal belief set. Equally, avoiding guilt/anxiety or feeling otherwise compelled to act (i.e., *situation*) may relate to an individual's traits and/or worldview, and are unlikely to promote positivity in any event.

In summary, PP interventions typically require an active participant and an intention to generate a general positive experience. Thus, the task here (i.e., Card Sorting Task, CST; see *Card Sort* below) might be better considered an 'intervention-light', or 'quasi-intervention' (for lack of a better term). The task is passive (i.e., non-directive, reflection on character strengths is unconstrained), and any 'interventional effects' derive from implicit, self-guided reflection. Further, the CST builds on assumptions that character strengths are inherently positive (e.g., Peterson & Park, 2009), and aims to uncover whether 'implicit' focus on/awareness of strengths impacts subsequent cognitive and behavioural performance.

Methodological Considerations

Card Sorting

Card sorting, as an activity, has been applied in varied settings, from evaluating CF (i.e., WCST; see *Chapter 2*) to assessing development of mathematical abilities (Eli, Mohr-Schroeder & Lee, 2011). Particularly relevant, character strengths cards have been validated as a 'tactile resource for passive reflection' (i.e., interacting with character strengths cards in order to engage/reflect on them) by Resnick and Rosenheck (2006). Patients were provided with signature character strength cards for "...direction and encouragement during treatment planning sessions, clinical groups, and even casual conversation" (pp. 122).

For the current studies, the Card Sorting Task (CST) has been adapted from a Positive Psychology (PP) coaching resource (Capp & Co, 2015). The cards

are typically used in gamified exercises (i.e., by strengths practitioners), enabling reflection on personal strengths in a dynamic and interactive way. Each of the 60 cards display a different character strength (e.g., creativity; see *Method: Card Sorting Task* below). The cards are well validated as part of a wider Strengths Profile (Capp & Co, 2015; mean Cronbach's alpha across 60 strengths = .82). The task requires participants to review the 60 named character strengths (e.g., Resilience, Bravery, Love, Leadership, Prudence, Feedback etc; Capp & Co, 2015; See Appendix 1), and sort them into relevant categories (i.e., Realised Strengths, Weaknesses) based on how they relate to themselves personally. The cards were originally designed as a tool for individuals to identify and explore their character strengths using a tactile and dynamic method (Capp & Co, 2015), and have primarily been used in occupational settings (e.g., recruitment). In addition, the standard procedure has been adapted to include a simple 'engagement-focus' process, in which participants are asked to select the two most representative cards from each category. In this way, it is possible to draw attention to the most subjectively relevant character strengths in the deck (i.e., implicitly reinforcing a minimal level of personal reflection, without increasing the risk of bias, such as demand characteristics, social desirability etc.).

Use of a Free-Response Questionnaire

To support the aim of convergence of qualitative and quantitative data strands mentioned earlier (Chapter 3), an open-ended questionnaire was included at the end of each study (see Materials below). Three prompts encourage participants to, 1) describe the experience of strengths reflection, 2) consider any connection between the CST and CF paradigms, and 3) describe any general thoughts or ideas elicited during the task. The free-response questionnaire allows data from their subjective experience of the task to be recorded alongside quantitative data, alongside more evaluation of CST efficacy as an intervention.

The tasks used to explore character strengths are detailed below, followed by three studies in which connections between character strengths

(and implicitly, the BBH) and CF are explored. Three paradigms (Chapter 3) have been selected to gauge impact of character strengths on CF. Study 1 explores CST impact on a straightforward CF application: a Navon Task (1981; adapted to include an alternating-run-task-switch, Rogers & Monsell, 1995). Study 2 uses a more complex CF paradigm: The Adaptive Choice Task (Irons & Leber, 2015). As well as traditional performance measures (i.e., RT, Accuracy), this evaluates optimality of participant choices (i.e., how effectively participants engage with their environment). Finally, in Study 3, higher-level aspects of CF are examined (i.e., creativity, fluency, novelty-based problem solving) using the Alternative Uses Task (Guildford et al, 1978). For each study, a typical reporting format will be followed. After Study 3, the CST will be evaluated across all three studies.

Bayesian Analysis

On a practical note, Bayesian Analysis have also been included to replicate the frequentist analysis. Here, the purpose of the Bayesian analysis is to account for both experimental power and avoidance of Type 1 error, due to the number of analyses required by a complex design. It is of note that the understanding and application of Bayesian statistics, particularly in regards of analyses more advanced than t-tests (i.e., ANOVAs) is ongoing (see Wagenmakers et al, 2018), and prudence should be exercised when considering the results. Nevertheless, the value here of Bayesian analysis is to indicate how much evidence there is to support an effect, or indeed evidence to support there not being an effect.

Here, the intention is not to delve into this complex area of research (see van de Schoot et al, 2017 for a review), but instead to highlight the basic parameters in which Bayesian analysis is applied and interpreted in this thesis. Analysis of Effects are reported in text as BF_{10} , which compares evidence in support of the alternative hypothesis (H_1) to evidence in support of the null hypothesis (H_0). These analyses are described in terms of their strength of support for either H_1 or H_0 using the system recommended by Wagenmakers et al (2018; Table 2). For transparency, evidence that is moderate or stronger is

considered important; in contrast anecdotal evidence denotes that there is not sufficient evidence to meaningfully support either hypothesis.

Table 2. A descriptive classification system for interpreting Bayes Factors from Wagenmakers et al (2018)

Bayes Factor	Evidence category
> 100	Extreme
30 - 100	Very Strong
10 - 30	Strong
3 – 10	Moderate
1 – 3	Anecdotal
1	No evidence
0.33 – 1	Anecdotal
0.10 – 0.33	Moderate
0.03 – 0.10	Strong
0.01 – 0.03	Very Strong
< 0.01	Extreme

Study 1: CST and Navon Task (NT)

The NT (Navon, 1977; 1981, see Chapter 3 for more details) is a perceptuo-attentional task typifying the lower-level cognition examined alongside the BBH in previous research (Fredrickson & Branigan, 2005). In practical terms, its use here will allow for an effective baseline measure of performance in conjunction with the CST. However, we should also note that because it lacks the characteristic behavioural components linked with CF above (e.g., adapting to environmental changes, see Chapter 2) - an additional

response-switching element was added, to ensure cognitive complexity/task demand was sufficient to engage higher order cognition.

The preliminary aim of this study is to evaluate the efficacy of the CST character strengths ‘light’ intervention in enhancing cognitive performance. Thus, the key research question is whether participants who complete the CST perform better on the NT than control counterparts. Additionally, it may be important to evaluate whether individual differences in CST engagement (i.e., the frequency with which cards are assigned to the different categories e.g., strengths, weaknesses etc.) correlate with RT and accuracy performance in the NT.

The qualitative data will allow insight into participants’ subjective experience of the CST. More generally, these data will be analysed to assess participants’ introspection on the CST (and more general character strength reflection); given the positive subject matter, the experience is likely positive. Additionally, qualitative data will be used to explore whether participants identify a connection between CST and NT performance.

Method

Participants. Fifty participants were recruited for this study (44 female); age ranged from 18-20 years ($M = 18.86$; $SD = 0.71$). Forty-one (82%) of the participants self-reported English as their first language, a further three as Chinese (6%), and two as Romanian (4%); the remainder reported German, Spanish, Polish, and Malay (2% each). Participants were recruited from a panel of first year undergraduate psychology students at the University of Warwick, who each received course credit for their participation.

Measures and Stimuli

Card-sort Task (CST). This task required participants to sort all 60 cards depicting character strengths into different categories (see *Procedure* section below). The four quadrants (Figure 11) which cards were sorted into were: 1) ‘Realised Strength’ (i.e., considered to be something the participant was good at,

enjoyed, and was most representative of themselves). 2) Unrealised Strengths (i.e., something thought to be good at, albeit underused and/or representing an area for development). 3) Learned Behaviour (i.e., something done well, but not enjoyed and done through necessity). Finally, 4) Weaknesses (i.e., something not done well, and leaving the individual demotivated or feeling negative; Capp & Co, 2015).



Figure 11. Adapted version of the quadrant from Capp & Co (2015), with a brief of what each category relates to. The quadrant is used as both a practical aid for participants (i.e., where to sort each card), as well as a reminder throughout the task to what each quadrant refers.

In addition, cards were grouped conceptually into five categories of strengths (i.e., “strengths families” which allow strengths to be clustered around a behaviour, activity, or interaction; Capp & Co, 2015). The categories are set out in Table 3 below. Note, the classification of these strengths, and how they are grouped is different (as well as the amount of named character strengths) compared to the more typical classifications used in PP literature (i.e., 24 strengths itemised in the Values in Action Inventory of Strengths; Peterson & Seligman, 2004; McGrath, 2017).

Table 3. The five categories of strengths within the CST

Category	No.	Definition	Example
Being	14	How an individual interacts with their wider world	Curiosity, Gratitude, Pride
Communicating	8	Way of giving and receiving information	Feedback, Humour, Narrator
Motivating	13	Things that drive an individual to action	Persistence, Resilience, Drive
Relating	11	Relationships with others	Empathic, Connector, Enabler
Thinking	14	How an individual attends to and approaches situations	Creativity, Resolver, Planner

A standard deck of 52 playing cards was used in the control condition, with inclusion of eight random ‘duplicate’ cards (i.e., eight random cards taken from a second deck to bring the total number 60) of cards to match the experimental deck.

Navon Task. The NT is a computer-based visual task, in which participants are asked to find a pre-specified letter, presented as either a large (global) letter, or within a collection of smaller (local) letters (*Figure 12*). The program was presented using Blitz 3D (Blitz Research Ltd; Version 1.64), full screen on a Windows 7 64-BIT computer, using a HANNS.G screen with resolution of 1400 x 900 and a standard QWERTY keyboard. The computer was positioned at eye level, with an approximate viewing distance of 65cm.

Letters were approximately 67mm in width, and 76mm in height. The task presents a combination of letters which always included either an F or H, combined with either T or L. Trials were presented in three blocks, each comprising 112 trials, with 56 of each response type. Each combination of letters

(i.e., HL, HT, LH, TH, FL, FT, LF, TF) was presented seven times per block, in randomised order. Participants were instructed to search for and respond to the letters F and H.

However, in addition, they were instructed to change key-responses from F and H to D and J respectively, switching between response types every eight trials. No signal was provided to indicate when to switch, and participants were instructed to count and track when a change in response type needed to be made.

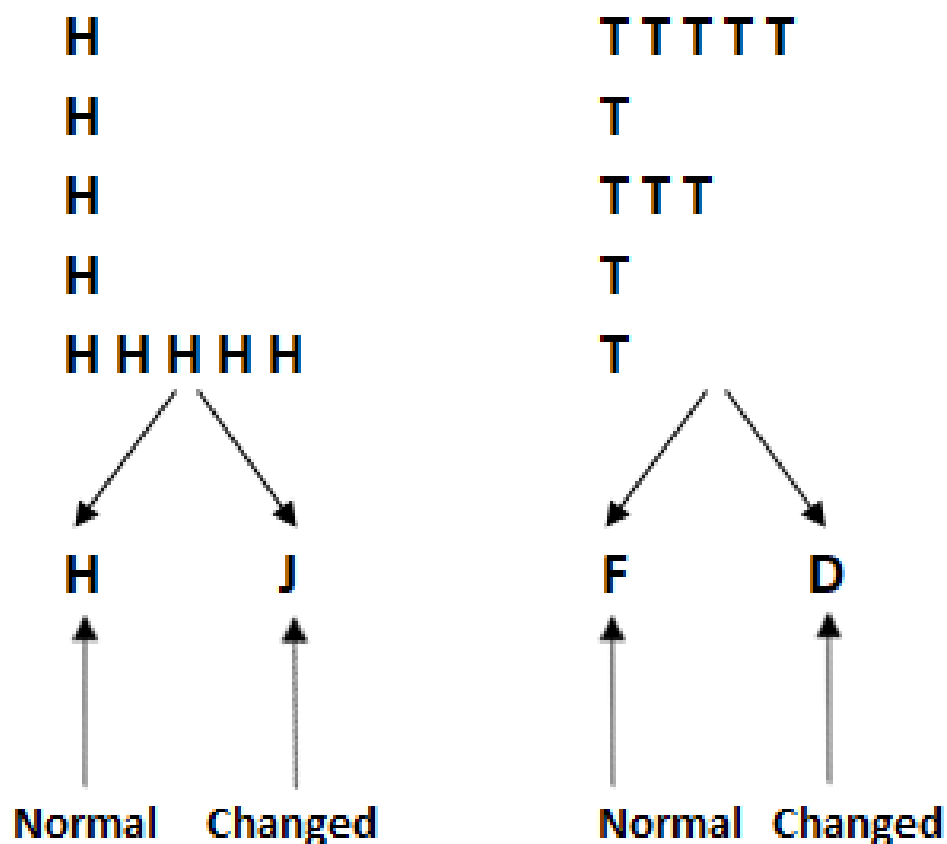


Figure 12. Example of a typical NT trial for both target letters, with the changes in response alignment.

Free-Response Questionnaire. To assess participant experience of the CST, qualitative data were collected via a free-response questionnaire. Participants received three prompts; 1) “Describe any thoughts or feelings you may have had during any aspect of the task”, 2) “Comment on how the card

sorting task may have effected your behaviour”, and 3) “Share any more comments or thoughts you may have about the task generally”. Participants could provide as much detail/feedback as they chose, without any time limitation, explicit or implicit.

Design. A MM design was used for this study. For the experimental aspect (i.e., CST effect on task performance), a 2 x 2 x 2 mixed factorial design was used. The between participants factor was Condition (Experimental, Control), and within participants factors were stimulus Perceptual Level (Global, Local, i.e., targets were either the large letter/small distractors, or the smaller letter/large distractor; see Figure 12), Response type (Normal, Changed; i.e., if the responded responding with F and H, or D and J). Dependant variables were Reaction Time (RT) and Accuracy (percentage error rate). For the observational element of the study, frequency data for CST quadrants (i.e., number of cards in a given quadrant; e.g., *Realized Strengths*), and card category within each quadrant (e.g., percentage of *Communication* cards in *Realised Strengths*) was collected. For the qualitative component, the free-response questionnaire was administered to all participants. These data were collected to address two specific questions; 1) what connection, if any, do participants discern between the CST and the NT; and 2) how participants experience the CST and resulting reflection on character strengths.

Procedure. Participants were randomly allocated to one of the Conditions (Experimental, Control) and were given an information sheet, before fully-informed consent was sought. Testing took place in individual sound-attenuated laboratory cubicles. To begin, detailed instructions (see Stimuli & Measures section above) were provided for either the CST (i.e., Experimental), or the control task.

CST Procedure. In the Experimental condition, participants were oriented to the deck of 60-character strength cards, with printed instructions describing the four CST quadrants (Figure 11). Participants were instructed to sort through the cards, assigning each to a quadrant, based on how they thought it related to them. They were requested to sort at a relaxed, but efficient pace, responding on

the basis of their first thought or impression. Once sorted, the experimenter asked participants to revisit their sorted cards, and select two from each quadrant they felt were most representative of themselves. In the control condition, participants were given a deck of standard playing cards plus eight additional 'duplicate' cards, and advised that these were in random order. Participants were instructed to sort cards into the four different sets (i.e., hearts, diamonds). Once sorted, participants were requested to sort through each set again to remove the duplicate cards.

NT Procedure. Following completion of the CST, participants were provided instructions for the NT. As depicted in Figure 12 above, they were informed verbally that, for each trial, a large capital letter (formed from smaller capital letters) would be presented, and participants should indicate whether an 'F' or 'H' was present (at either global or local level) by a key press corresponding to the letter presented. Participants were instructed that an 'F' or 'H' would always be presented (but never within the same trial), and requested to perform the task as quickly, but as accurately, as possible. Participants were also informed they would need to change the response keys every eight trials (F to D, H to J). They were instructed that no external indication for this change would occur, and they would need to track and change the response keys independently. If a response error was made participants were alerted via an on-screen message. Participants were given opportunity to clarify task instructions at this point, then undertook a brief practice block (16 trials, eight for each response type).

Finally, participants were given the free-response questionnaire. Here, they were asked to reflect on the study as a whole, and describe any thoughts or feelings that occurred to them at any point. In particular, participants were asked to consider what, if any, connection they detected between the CST and NT. More generally, participants were asked to comment on their experience of the CST, and any resulting thoughts and/or feelings that arose.

Following data collection, frequentist analyses were conducted using SPSS (IBM Corporation, 2016). Bayesian statistical analyses were also conducted,

using the free software JASP (version 0.9.0.1) and default priors (JASP Team, 2017). Free-response data were collated using nVivo (QSR International Pty Ltd, 2012), and analysed using a content analysis methodology (Hsieh & Shannon, 2005; Mayring, 2000).

Results

In order to simplify the structure of the following findings, this section has been divided into three subsections. Firstly, descriptive statistics are outlined, followed by questionnaire and experimental data (i.e., descriptive statistics for the NT, and subsequent inferential analyses). Next, Bayesian analysis is reported on NT data, to ensure a full and robust statistical approach to the data¹³. To avoid repetition of statistics, only noteworthy findings from the Bayesian analyses will be reported in detail. Finally, qualitative data will be explored using a Content Analysis methodology (Hsieh & Shannon, 2005), with textual presentation of the findings.

Descriptive Statistics

Card Sorting Task. Table 4 below displays the percentage of cards sorted into each quadrant (i.e., *Realised Strengths*, *Weaknesses*, *Learned Behaviours*, and *Unrealised Strengths*), reported by Strengths category (i.e., *Thinking*, *Communication*, *Relating*, *Being*, and *Motivation*). The *Realised Strengths* quadrant was populated most, with 32.92% of all cards being sorted here; conversely *Unrealised Strengths* was the least popular category, with 17.51%. Of particular interest, 50.54% of *Relating* were sorted to the *Realised Strengths* category.

To validate experimental CST data against convenience sorting (i.e., chance), a one-sample t-test was used to compare overall means for each quadrant to the 25% chance level. *Realised Strengths*, $t(24) = 4.38$, $p < .001$, and *Unrealised Strengths*, $t(24) = 5.07$, $p < .001$, were found to be significantly

¹³ Both in terms of experimental power and avoidance of Type 1 error, due to the number of analyses required by a complex design; Analysis of Effects are reported as BF_{10} .

different from chance, although *Weakness* and *Learned Behaviour* were not (t 's < 0.47 , $p' > .77$).

Table 4. Mean percentage (Standard Deviation in brackets) of cards by Strengths category and Quadrant.

Category	Quadrant			
	Realised Strengths	Weaknesses	Learned Behaviours	Unrealised Strengths
Mean	32.92 (9.03)	24.93 (6.64)	24.62 (6.58)	17.51 (7.37)
Thinking	21.71 (12.1)	34.28 (11.48)	28.28 (15.07)	15.71 (10.51)
Communication	33 (18.7)	27.5 (16.53)	20 (13.01)	19.5 (16.95)
Relating	50.54 (20.17)	11.27 (9.19)	22.9 (17.23)	15.27 (13.04)
Being	36.28 (15.41)	20.85 (8.72)	24.85 (14.74)	18 (13.69)
Motivation	23.07 (16.61)	30.76 (16.01)	27.07 (12.77)	19.07 (12.97)

NT Data. No outliers were removed from the data (screening was on the basis of pre-determined conservative ranges of between < 150ms to > 5,000ms for RT, and Error Rate of > 15%). Descriptive statistics for Navon performance are below in Tables 5 and 6, followed by a short summary of each variable. Briefly, the descriptive data suggests mixed findings, with the Experimental condition generally slower but more accurate.

Reaction Time. Across all factors, RTs for the Control condition were faster ($m = 764.10\text{ms}$, $SD = 134.21$), than the Experimental condition ($m = 788.40\text{ms}$, $SD = 132.26$). As expected, both conditions were faster for Global trials ($m = 746.38\text{ms}$) compared to Local ones ($m = 806.13\text{ms}$).

Table 5. RTs in milliseconds (ms) for NT performance, by Perceptual Level, Response Type and Condition

Level	Response Type	Condition*			
		Experimental		Control	
		Mean	SD	Mean	SD
Global	Normal	771.83	139.74	730.62	134.09
	Changed	744.54	118.62	738.52	152.13
	Global mean	758.19	129.18	734.57	143.11
Local	Normal	821.33	161.36	803.26	143.84
	Changed	815.89	137.35	784.01	130.97
	Local mean	818.61	149.36	793.64	137.41
Overall mean		788.40	132.26	764.10	134.21

**N = 25 per Condition*

Accuracy. In contrast to the RT data, the Experimental condition was, on average, more accurate ($m = 94.94\%$, $SD = 3.91$) than the Control condition ($m = 94.75\%$, $SD = 4.11$), although the numerical difference was negligible (0.19%).

Also in line with expectations, both conditions were more accurate for the Global trials ($m = 95.66\%$) compared to Local ($m = 94.04\%$).

Table 6. Error Rate in percentage (%) for NT performance, by Perceptual Level, Response Type and Condition

Level	Response Type	Condition*			
		Experimental		Control	
		Mean	SD	Mean	SD
Global	Normal	96.10	2.91	94.62	4.04
	Changed	96.00	3.18	95.90	4.14
	Global mean	96.05	3.05	95.26	4.09
Local	Normal	93.81	4.84	94.48	4.35
	Changed	93.86	4.70	94.00	3.90
	Local mean	93.83	4.77	94.24	4.13
Grand mean		94.94	3.91	94.75	4.11

**N = 25 per Condition*

Inferential Statistics

RT Data

Frequentist Analysis. A mixed 2 x 2 x 2 ANOVA was conducted on NT RTs (see Table 7), with within participant factors of Perceptual Level (Global, Local) and Response Type (Changed, Normal), and between participants factor Condition (Experimental, Control). There was a significant main effect of Perceptual Level with moderate evidence that global trials were faster than local trials, $F(1,48) = 45.94$, $p < .001$, $\eta^2 = .49$, $BF_{10} = 4.23$. There was also a three-way Perceptual Level x Response Type x Condition interaction, $F(1,48) = 4.60$, $p = .04$, $\eta^2 = .08$ (Figure 13). However, in contrast, the Bayes analysis indicated very

strong evidence for the factors not interacting ($BF_{10} = 0.01$). No other significant effects were found (all F 's < 2.74, all p 's > .10), with anecdotal evidence in support H_0 (all BF_{10} 0.15 - 0.24).

Table 7. Results of an ANOVA comparing RTs for Perceptual Level (PL), Response Types (RsT), and Condition, plus corresponding Bayes Factor

	F	df	p	ηp^2	BF_{10}
PL	45.94	1, 48	<.001	.49	4.23
RsT	2.75	1, 48	.10	.05	0.24
Condition	0.42	1, 48	.52	.01	0.27
PL * RsT	0.05	1, 48	.82	.00	0.17
PL * Condition	.01	1, 48	.94	.00	0.18
RsT * Condition	0.65	1, 48	.43	.01	0.15
PL * RsT * Condition	4.61	1, 48	.04	.09	0.01

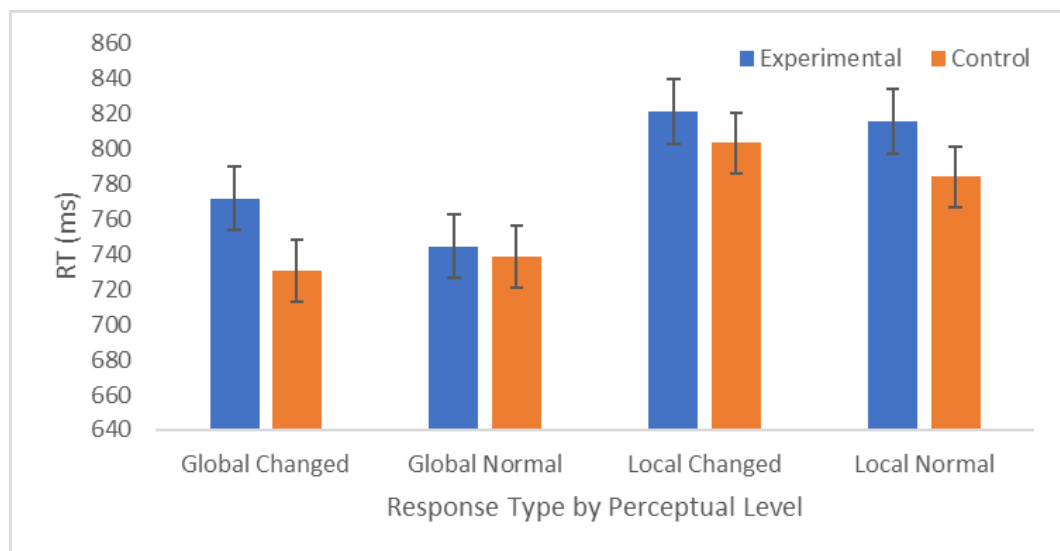


Figure 13. Graph showing RTs, between Perceptual Level and Response Type by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of CST sorting Quadrants. A Pearson's Product Moment correlation was conducted to scrutinize the data for any relationships between RT performance and CST categories (i.e., to establish the appropriateness of subsequent regression analyses). There were no significant relationships; all $r_s < .36$, all $p_s > .08$, therefore, no regression analyses were calculated. Subsequent Bayesian analysis suggested anecdotal evidence (all BF_{10} 0.41 – 0.64).

Accuracy data

Frequentist Analysis. Similarly to RT analysis, a mixed 2 x 2 x 2 ANOVA was conducted on NT Error Rates (%; see Table 8), with within participant factors of Perceptual Level (Global, Local) and Response Type (Changed, Normal), and between participants factor of Condition (Experimental, Control). A significant main effect for Perceptual Level with extreme evidence to suggest higher Accuracy for Global trials than Local, $F(1,48) = 13.39$, $p = .001$, $\eta p^2 = .22$, $BF_{10} = 503.40$. There were no other interactions/effects (all $F_s < 4.05$, all $p_s > .14$), and evidence was anecdotal (all BF_{10} 0.16 - 0.47).

Table 8. Results of an ANOVA comparing RTs for Perceptual Level (PL), Response Types (RsT), and Condition, plus corresponding Bayes Factor.

	F	df	p	ηp^2	BF_{10}
PL	13.39	1, 48	.001	.22	503.40
RsT	0.39	1, 48	.54	.01	0.16
Condition	0.04	1, 48	.84	.00	0.47
PL * RsT	1.16	1, 48	.29	.02	0.35
PL * Condition	1.81	1,48	.19	.04	0.21
RsT * Condition	0.49	1,48	.49	.01	0.27
PL * RsT * Condition	1.60	1, 48	.21	.03	0.29

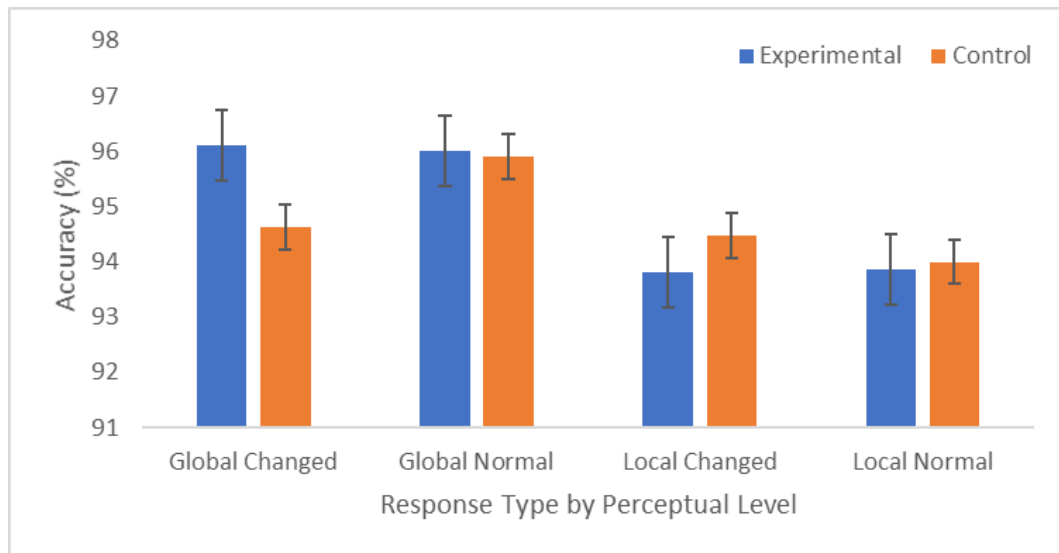


Figure 14. Graph showing Accuracy, between Perceptual Level and Response Type by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of CST sorting Quadrants. A Pearson's Product Moment correlation was conducted to assess any relationship between Accuracy and CST categories prior to any regression analyses. No significant relationships were found (all $r_s < .32$, all $p_s > .18$), therefore, no regression analyses were undertaken. Subsequent Bayesian analysis indicated anecdotal evidence in support of the null (all BF_{10} 0.28 – 0.80).

Qualitative Data

Participants' responses to the free response questionnaire were analysed using Content Analysis (CA; Hsieh & Shannon, 2005; Mayring, 2000). A directed 'top-down' approach was taken in analysing the data, extracting categories as reported by participants, with a view to addressing specific questions (e.g., "how do participants feel about reflecting on their character strengths?"; see *Measures and Stimuli/Design* above). For categories to be classified, codes had to occur across the across the data set and represent common ideas. Categories created from participants' responses, together with any additional categories/codes emerging after primary analysis, were also been identified and reported below. Finally, frequency data are not reported with the CA below for two reasons. The first is to keep the distinction between qualitative and

quantitative data strands concrete; “qualitative research is about meaning, not numbers” (Braun & Clarke, 2013, pg. 20). This is not to say transformation, or triangulation of qualitative data is not situationally useful (Creswell & Plano Clark, 2018), but here it is important to focus on the subjective experience of the CST. Second, the frequency information available for the categories is inconsistent (i.e., not all participants contribute to all categories), meaning any inferences that may be drawn about prevalence of categories are limited at best. To this end, the inclusion of frequency data may unfairly attribute more (or less) value to any given category.

Connection Between the Tasks. Four categories were identified from Experimental participants responses, plus a single category from Control participants (see Table 9 below). The most frequent category was that undertaking the CST had beneficial impact on NT performance (i.e., the *Beneficial* category; see Table 9 for examples). The *Detrimental* category did not necessarily contrast to the Beneficial, suggesting instead more ‘emotional’-style response which potentially affected approach to (or performance in) the NT. Similarly, *Reflective State* focused on identification of contemplation-oriented disposition following the CST. Finally, a small (but no less meaningful) proportion of participants saw no perceived connection between the CST and NT. Somewhat surprisingly, Control participants also suggested that their card sorting activity helped NT performance.

Table 9. Examples from each sub-category relating to the Connection between the tasks.

Sub-category	Example
Beneficial	<i>"May have impacted on the computer task as it makes you more determined to complete the task accurately and spend time to ensure you are answering correctly"</i>
Detrimental	<i>"This did make me feel quite sad actually, which carried over to the cognitive task"</i>
No Connection	<i>"I don't think it seemed to have a lasting effect on me"</i>
Reflective State	<i>"... so when the cognitive task began to bore me a little my attention began to slip and I was reminded of the weakness pile, which knocked my confidence a little"</i>
Positive Control	<i>"It also partially set my brain in motion since it is still morning"</i>

Character Strengths Reflection. In considering how participants experienced reflecting on their character strengths, three categories were identified (Table 10). Generally, responses suggested that participants enjoyed the CST itself, indicating a positive/pleasant experience. Beyond experience of the task itself, the remaining categories focused on two individual factors; *Focus on Strengths* and *Focus on Weaknesses*.

Items within the *Focus on Weaknesses* category generally suggested participants became preoccupied with their own weaknesses, either as a detrimental characteristic, and/or something to be overcome/compensated for. In contrast, the *Focus on Strengths* category highlighted the advantages in opportunities to reflect and acknowledge traits as strengths, particularly where these had not previously been considered.

Table 10. Examples of each of the Sub-Categories relating to the Reflecting on Character Strengths Category.

Sub-category	Example
Strengths	<i>"this task made me realise that I'm much more resilient and to some extent compassionate, compared to what I first thought"</i>
Weaknesses	<i>"Sorting task made me focus on my weaknesses- made me reflect on what kind of person I am"</i>
Enjoyment	<i>"It felt good to reflect on my strengths and choose my top two, it boosted my ego"</i>

Discussion

In considering quantitative findings alone, little difference is seen between conditions; Experimental and Control participants showed similar NT performance (both RTs and accuracy), with no relationship between CST frequency data and NT performance. Across the whole sample, NT data was as predicted (i.e., faster and more accurate on Global and Normal trials; Navon, 1978). Moreover, Bayesian analysis provides cautionary support for these findings (i.e., evidence supporting the faster/more accurate Global trials, anecdotal evidence for other interactions/effects). This suggests the NT worked as intended, but there is not sufficient evidence to say the CST failed to have an effect.

Qualitatively, the findings are also somewhat mixed. The CST was described as a broadly positive, enjoyable task, however some participants suggested a detrimental (or at least less positive) experience. Interestingly, participants also described a generally reflective state; this supports CST efficacy in enabling reflection on character strengths, at least at an anecdotal level.

Converging the data strands, it appears these findings are inconclusive overall. The CST proved effective in facilitating reflection on personal strengths, although the behavioural benefits postulated by the BBH are not evident. It is possible to suggest that NT demands were not sufficient to highlight robust behavioural differences (i.e., we saw 'ceiling-style' effects, in terms of the CF

needed for successful performance). However, given the NT was chosen for its alignment with the previous BBH literature (i.e., Fredrickson & Branigan, 2005), and potential ability to establish baseline CF demands levels, this does not indicate these data are not useful (i.e., they provide a useful foundation from which a better understanding can be built). The next step to clarify these findings is to combine the CST with a task comprising higher CF demand.

Study 2: Card Sorting Task, and Adaptive Choice Task

The NT allowed for initial exploration of CST efficacy, using a simple paradigm that both aligned with the previous literature (e.g., Fredrickson & Branigan, 2005) and addressed CF needed to engage/manipulate lower-level cognition (i.e., perceptuo-attentional processing). However, the findings suggest that cognition engagement necessary for effective NT performance may not have been sufficient to create a ‘cognitive landscape’ where CF was required. Overall, the behavioural and cognitive benefits that the BBH leads us to expect, did not emerge in Experimental participants.

This presents two options; perhaps the CST ‘intervention’ is not strong enough to elicit a positivity response via engagement with personal character strengths (cf participants focusing on strengths and enjoying the CST), and needs increased impact/robustness. Alternatively, the task demands of the cognition required (i.e., in the NT; Study 1) are insufficient for CF to emerge clearly. To focus on this second argument, use of the Adaptive Choice Task (ACT; Irons & Leber, 2015 Chapter 3 for more details) presents an opportunity to explore CST efficacy in a more cognitively-demanding task (i.e., dynamic, adaptive cognitive function in a changing environment).

The Current Study: Research Questions and Predictions

Similarly to Study 1, this study aims to evaluate the CST as an effective intervention to elicit positivity-based differences in cognitive performance (i.e., following BBH; Fredrickson, 2001). To repeat the primary research question outlined in Study 1, do Experimental participants perform better on the Adaptive

Choice Task (ACT) than their control counterparts? In addition, do subjective differences in CST engagement evidenced via qualitative analysis (e.g., category frequency) support enhanced ACT performance? Additionally, it may be important to evaluate whether individual differences in CST engagement (i.e., the frequency with which cards are assigned to the different categories e.g., strengths, weaknesses etc.,) correlate with RT, Accuracy, or Optimality performance in the ACT.

The qualitative data collected will allow for insight into the subjective experience of completing the CST. More generally, these data will be analysed to see how participants feel about the act of reflecting on character strengths; given the subject matter is positive of itself, the experience is expected to be positive. Additionally, the qualitative data will be used to explore what connection (if any) participants identify between the CST and performance on the ACT.

Method

Participants

Fifty participants were recruited for this study (39 female); age ranged from 18-21 ($M = 18.88$, $SD = 0.85$). Thirty-seven (74%) self-reported their first language as English, a further two as Chinese, Cantonese, Lithuanian, and French (4% each), and one each as Finnish, Tamil, Romanian, Arabic, and Italian (2% each). Participants were recruited from a panel of first year undergraduate psychology students at the University of Warwick, who each received course credit for their participation.

Measures and Stimuli

Card-Sort Task and Free Response Questionnaire. An identical CST intervention and free-response questionnaire as in Study 1, were used in Study 1 (see *Study 1: Methods* above).

Adaptive Choice Task (ACT; Irons & Leber, 2015). The ACT is a computer-based visual search task in which participants are instructed to find target stimuli in an array of distractors. The program was presented using MATLAB (The MathWorks, Inc; Version R2018a), in full screen mode on a Windows 7 64-BIT computer, using a HANNS.G screen (resolution of 1400x900) and a standard QWERTY keyboard. The computer was positioned at eye level, with an approximate viewing distance of 65cm.

In each trial, participants were instructed to identify a target (here, a red or blue square numbered between 2-5; integers only) from an array of distractors (red and blue squares numbered between 6-9, and green squares numbered between 2-9). Participants were asked to choose between two targets (circled in Figure 15; red '4', or blue '3'). A red and blue target was included in every trial, although the target number was always made numerically distinct (i.e., if red was 3, then blue would be 2, 4, or 5).

Distractor targets varied predictably across trials, with each colour ranging in its proportional representation within the array (i.e., more blue or more red distractors). Participants were instructed to make a key press to indicate a target had been found/selected (i.e., V = 2, B = 3, N = 4, M = 5). If a participant responded incorrectly, a visual cue was presented to indicate this (i.e., "Incorrect"). Participants completed three blocks of 84 trials each, with an option to take a self-paced break between each block, and were instructed to respond as quickly, but accurately as possible.

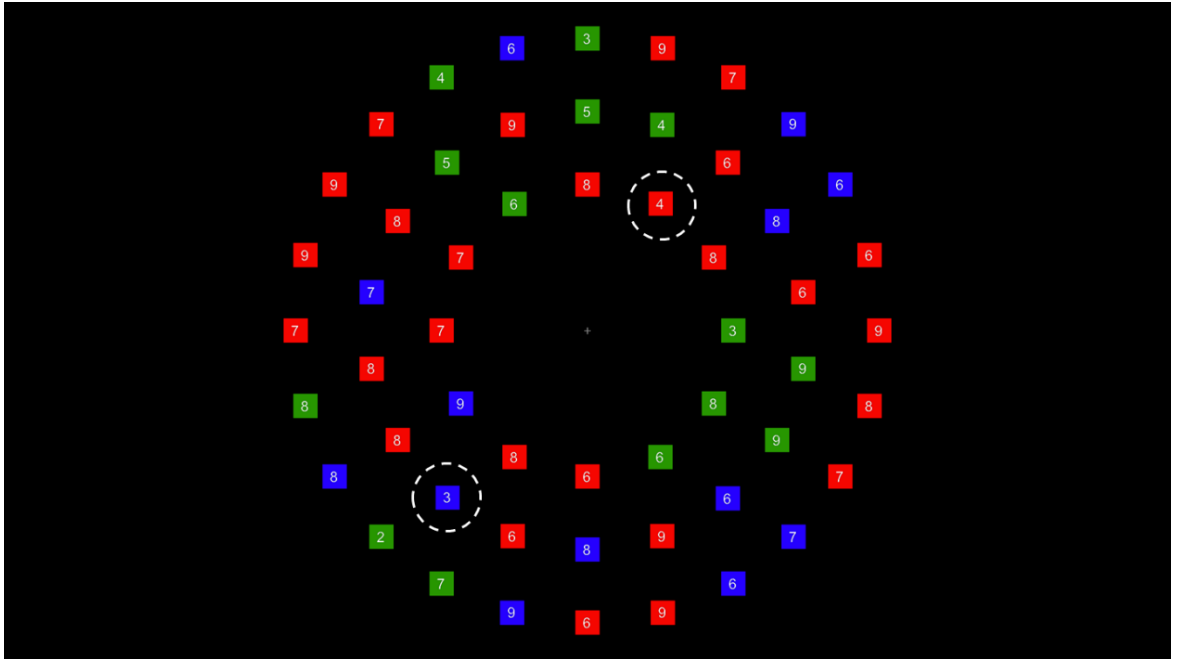


Figure 15. Typical ACT trial. Two correct target trials are outlined, participant would press 'B' for the blue target, and 'N' for the red target.

As per the original study by Irons and Leber (2013), three additional questions were administered to participants directly after ACT performance, in order to understand participant strategy for selecting targets. Participants were asked three questions; 1) *“During the cognitive task, how did you decide which target to search for? Were there any particular factors that made you want to respond to one instead of the other?”*. Next, they were asked, 2) *“Did you switch between the two targets? If so, what made you decide to switch?”*, and 3) *“On some trials, there were more blue items in the display, and other times there were more red items. Did you get the impression that this change occurred abruptly, or gradually?”*. Participants were able to provide as much detail/feedback as they chose, without any explicit or implicit time limitation.

Design

A MM design was used for this study. For the experimental aspect (i.e., CST effect on task performance), a 2 x 3 mixed factorial design was used. The between participants factor was Condition (Experimental, Control), and within participants factor was Block (One, Two, Three). Dependant variables were

Reaction Time (RT, ms), Accuracy (error rates, %), and Optimality (%; proportion of switches made by participants to less dominant target, e.g., from red to blue when more distractors are red). For the observational element of the study, frequency data for the CST quadrants (e.g., number of cards in Realised Strengths), and frequency of card category within each quadrant (e.g., percentage of Communication cards in Realised Strengths) was recorded.

For the qualitative component of the study, the free-response questionnaire was administered to all participants. These data were collected to address two specific questions; 1) what connection, if any, did participants discern between the CST and the ACT; and 2) how did participants experience the CST and any resulting reflection on character strengths. As indicated above, three additional ACT strategy questions were asked to address target selection strategy.

Procedure

Participants were randomly allocated to a Condition (Experimental, or Control), and followed the same procedure for the CST/control task as described in Study 1 (see pg. 88).

Following completion of the CST/control task, participants were instructed for the ACT. They were informed verbally to read the instructions carefully, and to signal the researcher if they had any questions before starting the task. Instructions were presented on screen, specifying that, for each trial, two targets would appear; one red square (with a number between 2 and 5), and one blue square (with a number between 2 and 5). All other squares would be red, green, or blue *and* have a number greater than 5. There would always be a red and blue target to find, but it was their choice which one they selected as their 'found' target. To indicate a target had been found, participants were instructed to press the key 'V' for 2, 'B' for 3, 'N' for 4, and 'M' for 5. A visual depiction of these instructions was also included, similar to Figure 15 above. Finally, participants were told that the targets for each trial would not be the

same number (i.e., if the red target was 2, then the blue had to be 3, 4, or 5), and that they should respond as quickly, but as accurately, as possible.

Finally, participants were given the free-response questionnaire. Here, they were asked to reflect on the study as a whole, and describe any thoughts or feelings that occurred to them at any point. In particular, participants were asked to consider what, if any, connection they detected between the CST and ACT. More generally, participants were also asked to comment on their experience of the CST, and any resulting thoughts and/or feelings that arose.

Following data collection, Frequentist analyses were conducted using SPSS (IBM Corporation, 2016) and Bayesian statistical analyses were also conducted, using the free software JASP (version 0.9.0.1) and default priors (JASP Team, 2017). Free-response data were collated using nVivo (QSR International Pty Ltd, 2012), and analysed using a content analysis methodology (Hsieh & Shannon, 2005; Mayring, 2000).

Results

In order to simplify the structure of the following findings, this section has been divided into three subsections. Firstly, descriptive statistics are outlined, followed by questionnaire and experimental data (i.e., descriptive statistics for the ACT, and subsequent inferential analyses). Next, Bayesian analysis is reported on ACT data, to ensure a full and robust statistical approach to the data¹⁴. To avoid repetition of statistics, only noteworthy findings from the Bayesian analysis will be reported in detail. Finally, qualitative data will be explored using a Content Analysis methodology (Hsieh & Shannon, 2005), with textual presentation of the findings.

Descriptive Statistics

Card Sorting Task. Table 11 shows the percentage of cards sorted by quadrant (i.e., *Realised Strengths*, *Weaknesses*, *Learned Behaviours*, and

¹⁴ Both in terms of experimental power and avoidance of Type 1 error, due to the number of analyses required by a complex design; Analysis of Effects are reported as BF₁₀.

Unrealised Strengths), and then by Strengths category (i.e., *Thinking*, *Communication*, *Relating*, *Being*, and *Motivation*¹⁵). The *Realised Strengths* quadrant was populated most, with 33.59% of all cards being sorted here; *Unrealised Strengths* was the least popular category, with 17.38%. Echoing previous results (see Study 1), nearly half (49.82%) of *Relating* were sorted to the *Realised Strengths* category.

To validate experimental CST data against simple convenience sorting (i.e., chance), a one-sample t-test was used to compare overall means for each quadrant to the 25% chance level. Both *Realised Strengths*, $t(24) = 5.65$, $p < .001$, and *Unrealised Strengths*, $t(24) = 5.61$, $p < .001$, were significantly different to chance (*Weaknesses* and *Learned Behaviours*; both $ts < 0.07$, both $ps > .47$).

¹⁵ Note: the CST required all cards to be sorted

Table 11. Mean percentage (Standard Deviation in brackets) of cards by Strengths category and Quadrant.

Category	Quadrant			
	Realised Strengths	Weaknesses	Learned Behaviours	Unrealised Strengths
Mean	33.59 (7.6)	24.13 (5.91)	24.9 (6.61)	17.38 (6.79)
Thinking	26.29 (11.79)	32 (12.9)	25.43 (10.73)	16.29 (12.63)
Communication	35.5 (15.6)	25 (13.98)	23 (14.29)	16.5 (11.25)
Relating	49.82 (16.41)	13.82 (10.2)	20 (14.37)	16.36 (10.5)
Being	35.43 (15.9)	24 (13.34)	23.14 (10.57)	17.43 (13.38)
Motivation	20.92 (11.44)	25.85 (12.93)	32.92 (15.78)	20.31 (13.3)

ACT Data. Outliers were removed from the data automatically (see Irons and Leber, 2013); for RT screening was on the conservative ranges of < 300ms to more than 3 standard deviations about the individuals RT mean, and Error Rate of > 15%. Tables 12 below includes descriptive statistics for ACT performance, coupled with a short summary of each variable.

Reaction Time. RTs were generally faster in the Experimental condition ($m = 2962.95\text{ms}$, $SD = 483.79$), although Control RTs showed minimal numerical difference ($m = 3043.82\text{ms}$, $SD = 767.95$); numerical RT difference between conditions was 80.87ms. No consistent differences were seen between conditions for block-dependent RT performance (i.e., both conditions were fastest on Block 3; Experimental $m = 2714.12\text{ms}$, Control $m = 2839.30$).

Accuracy. Again, both conditions have comparable Accuracy, with only 0.67% numerical difference between conditions (Experimental: $m = 96.78\%$, $SD = 3.33$; Control: $m = 96.11\%$, $SD = 3.67$). In the Control condition, Accuracy increased across the experiment duration (Block 1 $m = 94.48\%$, Block 3 $m = 97.00\%$), whereas the Experimental condition had the highest Accuracy for Block 2 ($m = 97.29\%$).

Optimality. Considering the frequency of switches to the least representative colour, participants in the Experimental condition displayed higher Optimality ($m = 58.03\%$, $SD = 15.72$), compared with Control participants ($m = 56.78\%$, $SD = 14.87$), although again, this difference was insubstantial in numerical terms. Overall, there was no clear pattern of optimality according to block-by-block analysis; both conditions improved between Blocks 1 and 2 (increase across both conditions $m = 4.49\%$), but declined between Blocks 2 and 3 (decrease across both conditions $m = -3.06\%$).

Table 12. ACT RT (ms), Accuracy (%), and Optimality (%), by Block and Condition.

Condition*	Block	Dependant Variable					
		RT		Accuracy		Optimality	
		Mean (ms)	SD	Mean (%)	SD	Mean (%)	SD
Control	1	3392.53	1014.14	94.48	5.59	56.02	16.84
	2	2899.63	714.05	96.86	2.89	59.29	15.03
	3	2839.30	623.23	97.00	4.05	54.99	16.54
	Grand Mean	3043.82	767.95	96.11	3.67	56.78	14.87
Experimental	1	3270.46	600.96	96.24	3.87	53.90	14.94
	2	2904.27	543.40	97.29	3.68	59.60	17.57
	3	2714.12	415.19	96.81	5.01	57.78	21.60
	Grand Mean	2962.95	483.79	96.78	3.33	58.03	15.72

Inferential Statistics

RT Data

Frequentist Analysis. A mixed 3 x 2 ANOVA was conducted on ACT RTs (Figure 16), with within participant factor of Block (1, 2, 3), and between participants factor of Condition (Experimental, Control). There was a main effect of Block, although only with anecdotal evidence, $F(1.46, 70.20) = 59.59$, $p < .001$, $\eta p^2 = .55$, $BF_{10} = 1.08$ ¹⁶. Planned post-hoc pairwise comparisons revealed that Block 3 was faster than both Block 1 ($p < .001$), and Block 2 ($p = .001$), and Block 2 was faster than Block 1 ($p < .001$). No main effect was found between Conditions with anecdotal evidence for H_0 , $F(1, 48) = 0.20$, $p = .66$, $BF_{10} = 0.40$. Finally, no interaction, with anecdotal evidence for H_0 , between Condition and Block was seen $F(2, 96) = 0.97$, $p = .39$, $BF_{10} = 0.38$.

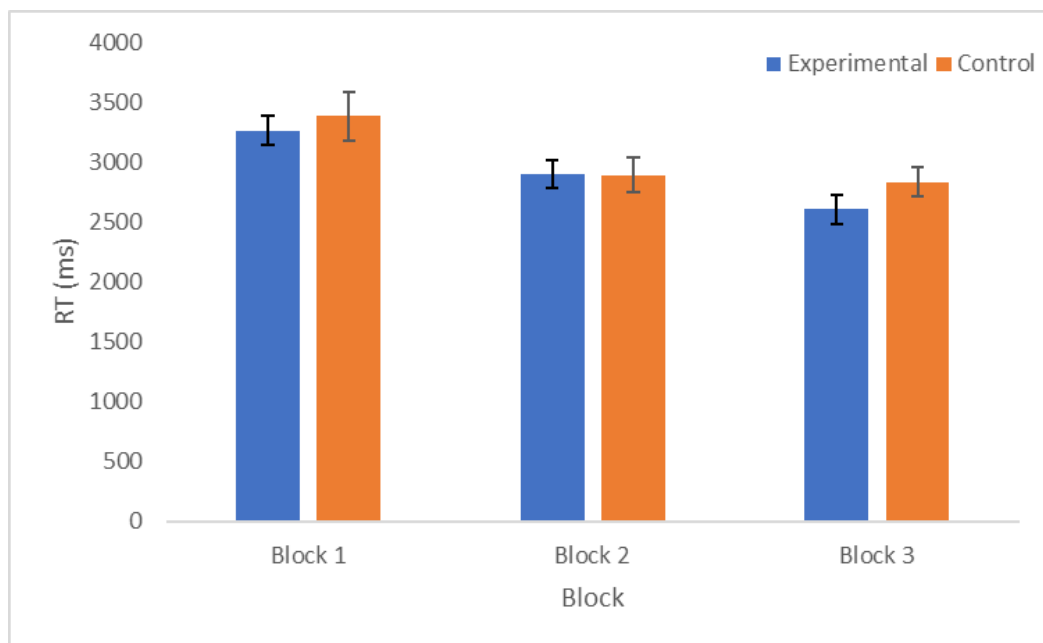


Figure 16. Graph showing RTs by Block and Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of CST Sorting Quadrants. A Pearson's Product Moment correlation was conducted to assess any relationship between RT and the CST

¹⁶ Mauchly's test of sphericity indicated that the assumption of sphericity was violated, $\chi^2(2) = 21.54$, $p < .001$, therefore the Greenhouse-Geisser correction has been used

categories. No significant relationships were found; all $r_s < .23$, all $p_s > .26$. Subsequent Bayesian analysis suggested anecdotal evidence in support of H_0 (all BF_{10} 0.32 – 0.52).

Accuracy data

Frequentist Analysis. A mixed 3 x 2 ANOVA was conducted on ACT error rates (%; Figure 17), with within participant factor of Block (1, 2, 3) and between participants factor of Condition (Experimental, Control). There was a main effect of Block¹⁷, although with anecdotal evidence for H_0 , $F(1.60, 76.91) = 4.97$, $p = .009$, $\eta p^2 = .09$, $BF_{10} = 0.11$, with highest accuracy in Block 2 and lowest in Block 1. Planned post-hoc pairwise comparisons by Block revealed no difference between Blocks 2 and 3 ($p = .72$), increased accuracy in both compared to Block 1 ($p = .004$, $p = .04$ respectively). No main effect was found between Conditions with anecdotal evidence in for H_0 , $F(1, 48) = 0.45$, $p = .50$, $BF_{10} = 0.17$. Finally, strong evidence in support of H_0 indicated Condition and Block do not interact, $F(2, 96) = 1.39$, $p = .26$, $BF_{10} = 0.05$.

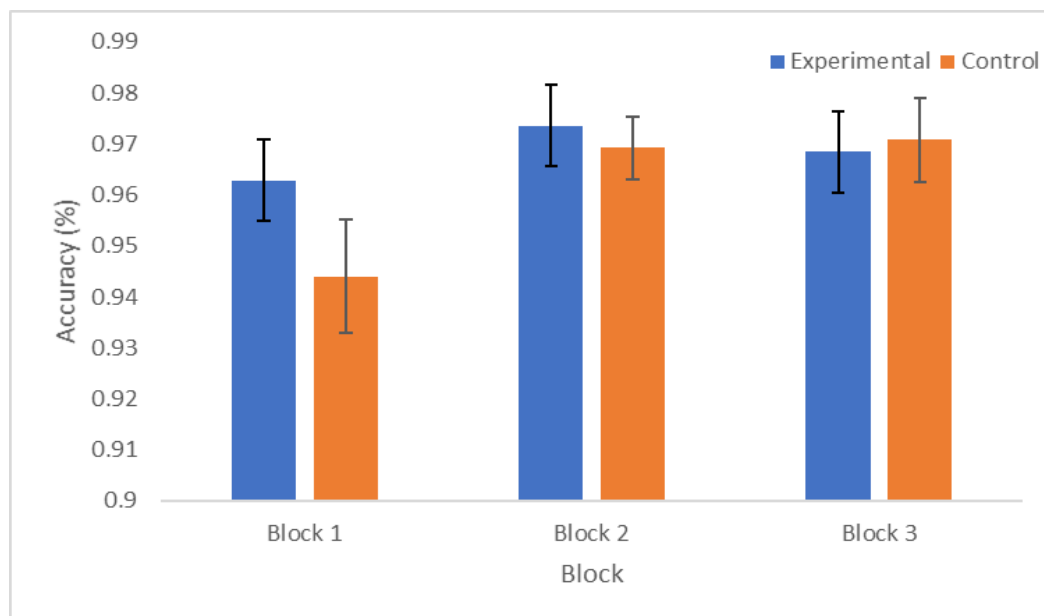


Figure 17. Graph showing Accuracy, Block by Condition. Error bars indicate ± 1 standard error of the mean.

¹⁷ Mauchly's test of sphericity indicated that the assumption of sphericity was violated, $\chi^2(2) = 13.41$, $p = .001$, therefore the Greenhouse-Geisser correction has been used

Predictiveness of CST sorting Quadrants. A Pearson's Product Moment correlation was conducted to assess any relationship between Accuracy and CST categories. A moderate positive correlation was found between Strengths and Accuracy, $r(25) = .45$, $p = .02$, but no other significant relationships were found; all $r_s < .25$, all $p_s > .24$, all BF_{10} 0.30 – 0.48. Subsequently, simple linear regression revealed number of cards categorised as Realised Strengths was a predictor of Accuracy ($t = 32.09$, $p = .02$, $R^2 = 0.20$), Accuracy was equal to $90.10 + (0.002 \times \text{strengths cards})$; see Figure 18. Subsequent Bayesian analysis suggested moderate evidence for H_1 in support of the relationship between Realised Strengths and Accuracy ($BF = 3.80$).

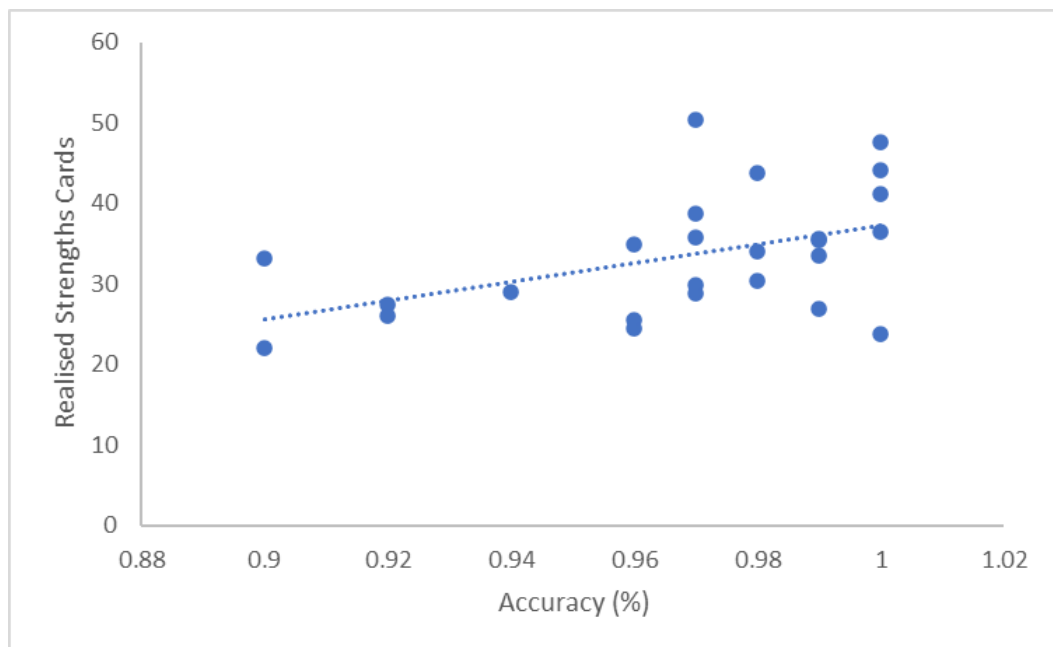


Figure 18. Scatterplot depicting relationship between categorised Realised Strengths cards and Accuracy.

Optimality data

Frequentist Analysis. A mixed 3 x 2 ANOVA was conducted on ACT Optimality (%; Figure 19), with within participant factor of Block (1, 2, 3) and between participants factor of Condition (Experimental, Control). There was a main effect of Block, although with anecdotal evidence for H_0 ¹⁸, $F(1.61, 77.24) =$

¹⁸ Mauchly's test of sphericity indicated that the assumption of sphericity was violated, $\chi^2(2) = 13.07$, $p = .001$, therefore the Greenhouse-Geisser correction has been used

3.91, $p = .03$, $\eta p^2 = .08$, $BF_{10} = 1.24$; highest Optimality was shown in Block 2, with lowest in Block 1. Planned post-hoc pairwise comparisons by Block showed less optimality in Block 1 than Block 2 ($p = .007$), although not in Block 3 ($p = .48$). In addition, more optimality was demonstrated in Block 2 than Block 3 ($p = .02$). No main effect was found between Conditions with anecdotal evidence for H_0 , $F(1,48) = 0.00$, $p = .94$, $BF_{10} = 0.36$. Finally, no interaction, with anecdotal evidence for H_0 , between Condition and Block was seen $F(2,96) = 1.32$, $p = .33$, $BF_{10} = 0.22$.

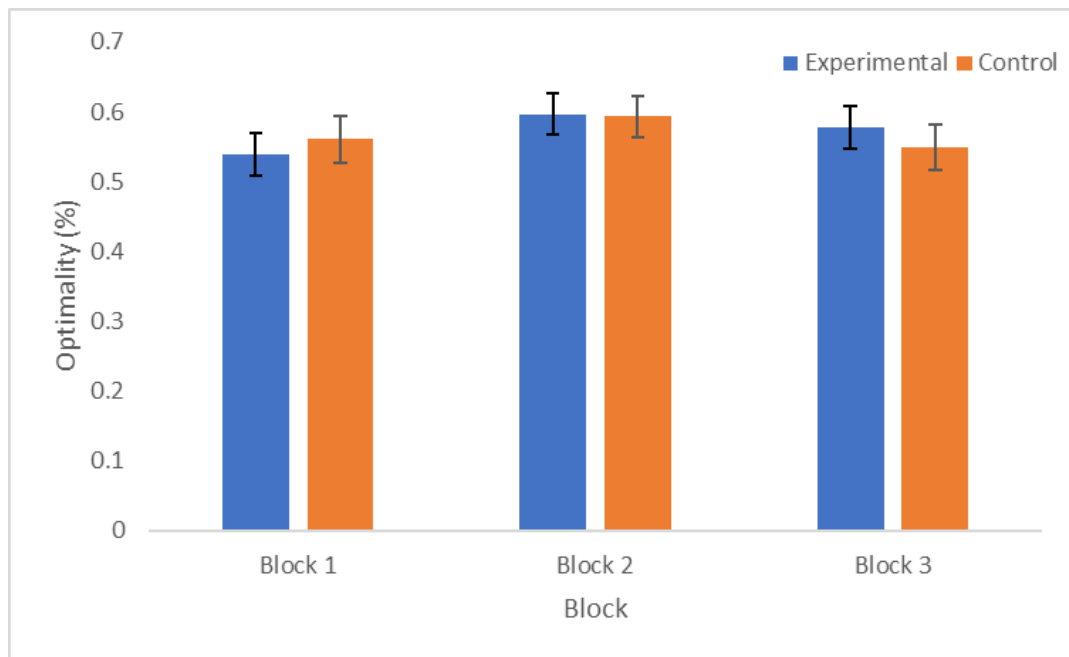


Figure 19. Bar graph showing Optimality by Block and Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of CST Sorting Quadrants. A Pearson's Product Moment correlation was conducted to assess any relationship between Switch Optimality and CST categories. No significant relationships were found; all r s $< .28$, all p s $> .16$, all BF_{10} 0.25 – 0.62. In slight contrast, anecdotal evidence for H_1 was found to support a negative relationship between Unrealised Strengths and Optimality, $r = -.45$, $BF_{10} = 2.77$.

Qualitative Data

ACT Strategies. Qualitative data was collected, in the same way as in Irons and Leber (2016), to explore participants' selection strategies during the

ACT. Given the brief, highly focused nature of responses, a content analysis procedure (e.g., Hseish & Shannon, 2005) was used to convert data into frequency categories. Responses to the three questions (see *Study 2: Materials* section) are shown below. Notably, participants were able to respond freely, therefore not all responses were coded (or codable), and some participants provided multiple answers to each question. In this latter case, responses were coded to their most representative category.

Target Selection Strategy. When asked about their target selection strategy, six categories were identified across the two conditions (Table 13 below). The majority of participants ($n = 24$) indicated an aim of optimality, searching only for the target within colour domain with the lowest proportion of distractor targets. However, 18% ($n = 9$) of participants decided to focus on one colour only, and a further 34% suggested less useful strategies. This ranged from complete strategy absence, to simple search until a target of either colour was found.

Table 13. Responses and frequency data for the Sub-Categories Relating to Target Selection, separated by Condition.

Sub-Category	E	C	Examples
<i>Blue Focus</i>	4	2	<i>"I felt that the colour blue jumped out at me more"</i>
<i>Red Focus</i>	1	2	<i>"I always looked for the red"</i>
<i>No Focus</i>	2	5	<i>"Started with whatever caught my eye"</i>
<i>Top Down</i>	1	0	<i>"Looking at it from the top to bottom"</i>
<i>First to Find</i>	4	2	<i>"Which ever one I saw first"</i>
<i>Smallest Proportion</i>	13	11	<i>"I chose the colour which was represented less"</i>

Note. E = Experimental condition, C = Control condition

Target Switching. Exploring target switching strategies (i.e., from red to blue and visa versa), four categories were evident (see Table 14 below). Half the participants (25) adhered to expected optimisation behaviour (i.e., switching when one colour formed a larger proportion of the distractors). The second most popular strategy ($n = 12$) was to avoid switching, followed by less optimal approaches, such as exhaustive searches (e.g., searching every block systematically).

Table 14. Responses and frequency data for the Sub-Categories Relating to Target Switching, separated by Condition.

Sub-Category	E	C	Examples
Proportion of Colour	13	12	<i>“Mostly went for blue but switched depending on how many numbers of a colour were present”</i>
No Specific Reason	4	3	<i>“I’m not sure why - possibly for variation, or to see if I found one colour faster than the other”</i>
Exhaustive Switch	4	2	<i>“If I couldn’t find a correct number on one colour I’d switch to the other”</i>
Location	2	2	<i>“I did switch between red and blue, mainly if a red target was in my immediate eye line when the trial started”</i>
No Switch	6	6	<i>“No”</i>

Note. E = Experimental condition, C = Control condition

Distractor Changes. Three categories emerged when participants’ awareness of distractor stimuli in each trial was probed; in other words, if participants noticed changes and change onset (see Table 15 below). The majority of participants ($n = 34$) suggested that the distractors switched abruptly, while a further 14 suggested the switch was more gradual. An additional five reported no awareness of distractors changing.

Table 15. Responses for each of the Sub-Categories Relating to Distractor Changes, by Condition.

Sub-Category	E	C	Examples
Abrupt	19	15	"Abruptly"
Gradual	7	7	"Gradually"
Unaware	2	3	"Didn't notice"

Note. E = Experimental condition, C = Control condition

Free Response Questionnaire. Participants' responses to the free response questionnaires were analysed using a Content Analysis methodology similar to Study 1. A 'top-down' approach was adopted to address two specific questions; 1) "how do participants feel about the CST?", and 2) "what, if any, connection do participants perceive between the CST and the ACT?". Importantly, qualitative analysis procedures recommend acknowledgement of implicit bias arising from prior analyses. Thus, while the content analysis here was conducted following standardised procedures, findings from Study 1 use of the CST have influenced (or are highly likely to have influenced) this analysis. On a pragmatic level, categories identified in previous analyses do not constrain this analysis (i.e., new, previously undefined categories have been used), but where similarities have occurred, this has been noted (e.g., via identical category names).

Connection Between the Tasks. In considering what, if any, impact of the CST participants perceived on ACT performance, two categories emerged for each Condition (see Table 16 below). In the Experimental condition, participants were divided between positive impact on ACT performance (*Impactful*), and perceiving no relationship between the tasks (*No Connection*). In the Control condition, responses were again divided, but here, between positive impact (*Impactful Control*), and negative impact (*Distracting Control*).

Table 16. Examples from each sub-category relating to the Connection between the tasks category.

Sub-category	Example
Impactful	<i>"I had attributed determination and various intelligent qualities to myself in the card-sorting exercise, I set myself a goal to get 100% in every block"</i>
No Connection	<i>"No conscious effect, was focused on the cognitive task alone"</i>
Distracting Control	<i>"As there was so many cards, there was a sense of tiredness/boredom from doing the task"</i>
Impactful Control	<i>"Prepared me for it"</i>

Character Strengths Reflection. One overarching category emerged when evaluating the reflection process itself. This *Positivity* category presented three sub-categories; 1) *Focus on Strengths*, 2) *Positivity Enhancement*, and 3) *Motivation and Determination* (Table 17 below). The most widespread sub-category (*Focus on Strengths*) illustrated that participants thought the CST facilitated focus on personal strengths. This extended beyond simple listing of strengths, into a general evaluation of strengths and their implications. The two other sub-categories were more evenly present throughout the dataset, and highlighted a more general positivity induced by the CST (i.e., an overall enhancement or boost). Similarly, reflecting on strengths was considered motivational in terms of the subsequent task, particularly in respect of current goal attainment.

Table 17. Examples of each of the Sub-Categories relating to the Reflecting on Character Strengths Category.

Sub-category	Example
Focus on Strengths	<i>"Made me rethink my cards, for example, attention to detail is actually a strength"</i>
Positivity Enhancement	<i>"During the card-sorting task, I felt very reflective of who I am as a person which brought up various emotions but boosted my positivity"</i>
Motivation & Determination	<i>"...using it as proof of my goal setting/determination. I was proud each time I got 100% in a block, even though I knew it wasn't any kind of exam, it gave me some validation of the qualities I had admired in the card-sorting exercise."</i>

Discussion

Quantitatively, the data suggest that while performance on the ACT is as anticipated within the literature (i.e., faster, more accurate and more optimal over time), very little difference is seen between the conditions. In other words, undertaking the CST appears to have no direct impact on ACT performance. More, Bayesian analysis for the most part was anecdotal, suggesting there is not sufficient evidence to say the CST failed or succeeded to impact on ACT performance. However, some evidence for an indirect relationship is seen; when more cards are sorted into the Strengths category, an increase in Accuracy is seen.

The qualitative data indicate a small difference in experience between conditions, with more experimental participants mentioning enhanced ACT performance. In addition, the CST itself was mostly considered to be a positive activity. Content analysis categories highlighted motivational impact of character strength reflection, and insight that participants enjoy focusing on realised strengths (as opposed to areas for development, or weaknesses). Moreover, the

CST was generally considered advantageous (or at worst, neutral), in facilitating ACT performance; a clear contrast with the control task. Taking both data strands together, greater focus on Strengths predicts more accurate, and arguably, a more cognitively flexible, performance; these conclusions were supported by Bayesian analysis, however, this support was not unequivocal.

Reviewing the CST

Here, a disagreement is seen between qualitative and quantitative results. Thus far, the impact on CF performance (i.e., via the NT and ACT) has been mixed, and in practical terms, this means the behavioural differences we would expect in accordance with the BBH have not been supported in any robust way. However, this lack of impact can be argued to reside mainly with the quantitative data (e.g., RT, accuracy, optimality data etc.) In contrast, the qualitative data suggests that Experimental participants report a more positive experience overall, as well as a general belief that the CST has a beneficial impact on subsequent task performance. Importantly for a holistic perspective, these data indicate this belief is preserved as cognitive task demand increases (e.g., when the task demands require more than a simple decision on perceptual stimuli etc.).

Following the debate detailed at the start of this study (i.e., regarding CST strength vs cognitive task complexity, see *Study 2: Card Sorting Task, and Adaptive Choice Task*) this divergence between data strands may emanate from both cognitive tasks selected. Studies 1 and 2 have employed well-validated perceptuo-attentional tasks (e.g., Brand & Johnson, 2014; Navon, 1981; Noguchi & Tomoike, 2016; see Chapter 3). Importantly, this type of cognitive task was originally used by Fredrickson and Branigan (2005), where enhanced attentional focus was demonstrated with positively valenced stimuli. However, the ACT requires an additional level of cognitive sophistication (i.e., with optimality, switches and individual differences in awareness of these components), which may account for less marked divergence between qualitative and quantitative findings for the ACT (Irons & Leber, 2016).

That said, this does not indicate that our current ‘intervention’ is working in a manner robust enough to impact on subsequent task performance; nor does it negate its use in a conclusive way. Thus, given that increasing the task demands of the cognitive task (i.e., in terms of the complexity and sophistication of the cognition required for performance) appears to indicate some enhanced engagement with CF, this avenue will be pursued. However, given the apparent need to probe cognition beyond perceptuo-attentional processing (i.e., in Studies 1 and 2), a traditional divergent thinking (i.e., Alternative Uses Task, Guilford et al, 1978; see *Chapter 3* for use in previous literature) paradigm will be used in Study 3. This final change in paradigm should allow clearer evaluation of CST impact on CF, but where the cognition required for baseline performance moves beyond lower level processing.

Study 3: CST and Alternative Uses Task

The original BBH research (Fredrickson and Branigan, 2005) has been characterized in this chapter so far by its use of perception- and attention-driven tasks (e.g., the NT, Navon, 1977). However notably, they also included a paradigm to measure impact on the thought-action repertoire (T-AR) beyond these lower-level cognitive processes (i.e., participants who experienced positive emotions also recorded more numerous thought-actions; Fredrickson & Branigan, 2005). The Alternative Uses Task (AUT; Guilford et al, 1978; see *Chapter 3*) was developed to explore explicit flexibility and creativity in responses to a ‘divergent thinking’ task.

In this study, AUT use will change the focus on the type(s) of cognition we examine in relation with CF. Specifically, enhanced CF has been supported by qualitative data in Studies 1 and 2, but this paradigm will allow for more abstract broadening of the T-AR to be measured, and for the CF involved in abstract task performance to be evaluated. However it is important to note that the AUT will be presented in similar conditions to the cognitive tasks in Studies 1 and 2. For example, participants will complete the task in segments (similar to experimental blocks) and under time constraints within a laboratory environment. While

arguably, this may ‘constrain creativity’ in lay terms, pragmatically speaking, it supports consistency between the three tasks in this chapter.

The current study: Research questions and predictions

Based on the findings of Studies 1 and 2 (and the BBH literature, e.g., Fredrickson and Branigan, 2005), behavioural benefit in task performance is predicted for participants in the Experimental group. For example, we anticipate more acceptable alternative uses (and fewer rejections) in Experimental participants. In addition, we would expect increases in flexible, elaborative, and original uses proposed by this group.

As in Studies 1 and 2, qualitative data will give insight into participants’ subjective experience of the CST. More specifically, we will ask whether individual (subjective) differences in CST engagement (i.e., category frequency) result in enhanced overall AUT performance (i.e., more alternative uses for the household items). Evaluation of character strength reflection itself and CST potential as a real-world intervention will be explored via Content Analysis (Hsieh & Shannon, 2005). Our focus is whether the CST is a pleasant activity and/or whether participants would engage in character strengths reflection (more generally, perhaps) on their own initiative; based on the previous studies, it is expected that participant will enjoy the CST.

Method

Participants

Originally fifty participants were recruited, however four were removed having failed to follow the instructions. Of the remaining forty-six participants (38 female), age ranged from 18-27 years ($M = 19.13$; $SD = 1.43$). Thirty-five participants (76.09%) self-reported English as their first language, a further six (13.04%) reported Cantonese as their first language. The remainder reported Russian, French, Spanish, Malay, and Korean as their primary languages (2.17% or one each). Participants were recruited from a panel of first year

undergraduate psychology students at the University of Warwick, who each received course credit for their participation.

Measures and Stimuli

Card-Sorting Task and Free Response Questionnaire. An identical CST and free response questionnaire (i.e., as in Studies 1 & 2; see *Card Sorting Task*) were used in Study 3.

Alternative Uses Task (AUT; Guilford et al., 1978). Here, participants were asked to generate novel uses for household items (e.g., a newspaper). The task was separated into four sections, each containing four different items; participants are given a time limit for task performance (4 minutes per Section). Five measures are taken from participants to reflect functions of creativity/fluency (and by extension CF). These comprise two that focus on quantitative aspects of performance; 1) Fluency (total number of acceptable responses) and 2) Flexibility (number of categories acceptable uses related to). The remaining three focus on the quality of the responses themselves; 3) Elaboration (how much participants elaborated on their answers), 4) Originality (how original the suggested use was compared to the rest of the sample), and 5) Accuracy (how many suggested uses were considered acceptable).

AUT Analysis. Initially, responses were coded by one researcher (see Guilford et al., 1978 handbook), however to ensure objectivity/consistency, the analysis was reviewed by a second coder (i.e., to verify accepted/rejected responses). Responses were rejected if they met one of the following two conditions; firstly, this occurred if the response was a repetition of a previous answer in the same part of the task (e.g., A or B) by the same participant. For example here, 'safety pin' and 'key' might both be used as jewellery, but if the participant had just stated 'jewellery' or phrased the use in the same way for both, it would be rejected the second time. Secondly, responses were also rejected if the proposed use was not feasible, or did not make sense without further explanation. For example, an unacceptable response would be 'glasses-

start a fire', however, 'glasses- lens used to focus light and start a fire' would be accepted.

Fluency was calculated as the total acceptable responses for each section, with *accuracy* representing total rejected responses. The *elaboration* score was determined based on the detail included in an acceptable response. Thus, 'bedsheet-protect furniture' would receive no elaboration points, whereas 'bedsheet- protect furniture when painting' would receive one point. *Flexibility* scores were obtained by summing the different use categories for each item. In this case, 'shoe- used as a plant pot', 'shoe- used to squash bugs', and 'shoe- used as a weapon' would receive two flexibility points; one for decoration, and one for weapon. Finally, *originality* was scored by comparing the frequency of accepted responses across the whole participant sample. For example, a use provided by fewer than 1% of the sample (in this instance, once) would accrue two points, and by fewer than 5% (twice), one point.

Design

A MM design was used for this study. For the experimental aspect (i.e., CST effect on AUT performance), a 2 x 4 mixed factorial design was used with the between participants of Condition (Experimental, Control), and within participants factor Section (1, 2, 3, 4). The dependant variables were Error Rate (%), Fluency, Flexibility, Originality, Elaboration and. For the observational element of the study, frequency data for CST quadrants (e.g., number of cards in Realised Strengths), and frequency of card category within each quadrant (e.g., percentage of Communication cards in Realised Strengths) was recorded.

For the qualitative component of the study, the free-response questionnaire was administered to all participants. These data were collected to address two specific questions; 1) "what connection, if any, do participants discern between the CST and the AUT?"; and 2) "how do participants experience the CST and resulting reflection on character strengths?".

Procedure

Participants were randomly allocated to a Condition (Experimental, or Control), and followed the same procedure for the CST/control task as described in Study 1 (see pg. 88).

Following completion of the CST, participants were presented with written instructions for the AUT. Participants were informed that they would be presented with some common objects with a defined use (e.g., *newspaper; used for reading*), and that their task was to think of up to six alternative uses for each item. Participants were provided with a completed example (i.e., six alternative uses) for *newspaper* and instructed to note each of the uses listed were different from each other and from the primary use. Participants were presented with three items per section, with four minutes for each section. They could complete all three items in each section simultaneously, but they could not return once the four minutes were complete. Participants were given a chance to ask questions before the first Section started.

Finally, participants were given the free-response questionnaire in which they were asked to reflect on the study as a whole, and describe any thoughts or feelings that occurred to them at any point. In particular, participants were asked to consider what, if any, connection they detected between the CST and ACT. More generally, participants were also asked to comment on their experience of the CST, and any resulting thoughts and/or feelings that arose.

Following data collection, Frequentist analyses were conducted using SPSS (IBM Corporation, 2016). Bayesian statistical analyses were also conducted, using the free software JASP (version 0.9.0.1) and default priors (JASP Team, 2017). Free-response data were collated using nVivo (QSR International Pty Ltd, 2012), and analysed using a content analysis methodology (Hsieh & Shannon, 2005; Mayring, 2000).

Results

In order to simplify the structure of the following findings, this section has been divided into three subsections. Firstly, descriptive statistics are outlined, followed by questionnaire and experimental data (i.e., descriptive statistics for the AUT, and subsequent inferential analyses). Next, Bayesian analysis is reported on AUT data, to ensure a full and robust statistical approach to the data¹⁹. To avoid repetition of statistics, only noteworthy findings from the Bayesian analysis will be reported in detail. Finally, qualitative data will be explored using a Content Analysis methodology (Hsieh & Shannon, 2005), with textual presentation of the findings.

Descriptive Statistics

Card Sorting Task. Table 18 below displays the percentage of cards sorted into each quadrant (i.e., *Realised Strengths*, *Weaknesses*, *Learned Behaviours*, and *Unrealised Strengths*), and then by Strengths category (i.e., *Thinking*, *Communication*, *Relating*, *Being*, and *Motivation*²⁰). The *Realised Strengths* quadrant was populated most, with 38.89% of all cards being sorted here; conversely *Unrealised Strengths* was the least popular category, with 15.69%. Of particular interest, 56.13% of *Relating* were sorted to the *Realised Strengths* category.

To validate experimental CST data against convenience sorting (i.e., chance), a one-sample t-test was used to compare overall means for each quadrant against a 25% chance level. Three quadrants' frequencies were significantly different to chance; *Realised Strengths*, $t(22) = 5.35$, $p < .001$, *Learned Behaviour*, $t(22) = 4.02$, $p = .001$, and *Unrealised Strengths*, $t(22) = 6.09$, $p < .001$. However, sorting into the *Weaknesses* quadrant was not different to chance, $t(22) = 0.53$, $p = .60$.

¹⁹ Both in terms of experimental power and avoidance of Type 1 error, due to the number of analyses required by a complex design; Analysis of Effects are reported as BF_{10} .

²⁰ Note: the CST required all cards to be sorted

Table 18. Mean percentage (Standard Deviation in brackets) of cards by Strengths category and Quadrant.

Category	Quadrant			
	Realised Strengths	Weaknesses	Learned Behaviours	Unrealised Strengths
Mean	38.89 (12.46)	25.91 (8.20)	19.51 (6.55)	15.69 (7.33)
Thinking	33.23 (19.93)	32.92 (14.72)	19.57 (11.24)	14.29 (10.77)
Communication	39.13 (20.75)	28.80 (15.28)	16.85 (14.89)	15.22 (14.08)
Relating	56.13 (21.87)	15.02 (14.40)	13.04 (13.93)	15.81 (15.07)
Being	38.20 (16.90)	22.36 (12.80)	22.36 (12.24)	17.08 (11.55)
Motivation	27.76 (17.47)	30.43 (20.68)	25.75 (14.60)	16.05 (10.61)

AUT Data. No outliers needed to be removed from the data. Descriptive statistics for AUT performance by dependant variable are displayed in Table 19; each variable is followed by a short summary.

Fluency. Collapsed across Section, higher Fluency score were seen in the Experimental condition ($m = 2.41$, $SD = 0.63$), compared to the Control ($m = 1.79$, $SD = 0.76$). A small numerical improvement in Fluency over time was evident for the Experimental condition (Section 4; $m = 2.51$, $SD = 0.77$; Section 1, $m = 2.46$, $SD = 0.80$). In contrast, Control participants Fluency decreased steadily after Section 1 ($m = 1.99$, $SD = 0.85$; Section 4 $m = 1.71$, $SD = .82$).

Flexibility. As with Fluency, when collapsed by Section the Experimental condition had the highest Flexibility score ($m = 1.64$, $SD = 0.33$) compared to the Control condition ($m = 1.24$, $SD = 0.43$). For both Conditions, the highest flexibility score was achieved in Section 1 (Experimental $m = 1.75$, $SD = 0.58$; Control $m = 1.42$, $SD = 0.48$).

Elaboration. Elaboration scores were generally low ($m = 0.53$ collapsed by all factors), the Experimental condition ($m = 0.68$, $SD = 0.37$) continues to outperform the Control condition ($m = 0.38$, $SD = 0.33$). Unexpectedly, Section 3 saw the highest Elaboration scores for both conditions (Experimental; $m = 0.72$, $SD = 0.57$; Control; $m = 0.42$, $SD = 0.40$).

Originality. Originality scores were also low. Collapsed across Section, the Experimental originality scores were higher ($m = 0.81$, $SD = 0.68$), with the best score for Section 1 ($m = 0.97$, $SD = 1.10$). Highest Originality performance for the Control condition was also seen in Section 1 ($m = 0.78$, $SD = 0.90$), with a grand mean of 0.66 ($SD = 0.69$) across all Sections.

Error Rate²¹. Finally, as with the data reported above, a lower error rate ($m = 22.38\%$, $SD = 12.62$) was seen in the Experimental data, compared to Control ($m = 37.39\%$, $SD = 20.87$). Both Conditions had the lowest error rate for Section 1 (Experimental; $m = 14.35\%$, $SD = 17.13$; Control; $m = 27.30\%$, $SD =$

²¹ If a participant failed to provide any alternative uses for an item, then the Error Rate was recorded as 100%.

19.67). Overall, performance in the Control condition was weaker in accuracy terms with nearly half of the suggested uses rejected in Section 2 ($m = 41.40\%$, $SD = 32.63$).

Table 19. Descriptive statistics for Dependant Variables measured in the Alternative Uses Task, by Condition and Section.

Condition*	Section	Dependant Variable									
		Fluency		Flexibility		Elaboration		Originality		Accuracy (%)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control	1	1.99	0.85	1.42	0.48	0.35	0.34	0.78	0.90	27.30	19.67
	2	1.54	0.89	1.13	0.59	0.42	0.43	0.54	0.66	41.40	32.63
	3	1.94	0.95	1.23	0.50	0.42	0.40	0.62	0.79	36.72	21.73
	4	1.71	0.84	1.17	0.56	0.35	0.42	0.71	0.82	37.39	20.87
	Grand mean	1.79	0.76	1.24	0.43	0.38	0.33	0.66	0.69	37.39	20.87
Experimental	1	2.46	0.80	1.75	0.58	0.71	0.66	0.97	1.10	14.35	17.13
	2	2.38	0.79	1.75	0.53	0.62	0.54	0.90	0.88	20.22	18.06
	3	2.29	0.72	1.45	0.48	0.72	0.57	0.64	0.80	28.87	17.37
	4	2.51	0.77	1.62	0.43	0.67	0.45	0.74	0.71	22.38	15.80
	Grand mean	2.41	0.63	1.64	0.33	0.68	0.37	0.81	0.68	22.38	12.62

*N = 23 per Condition.

Inferential Statistics

Fluency

Frequentist Analysis. A mixed 2 X 4 ANOVA was conducted on AUT Fluency scores (Figure 20), with within participant factor of Section (1, 2, 3, 4), and between participants factor of Condition (Experimental, Control). There was a main effect and moderate evidence for a difference between Conditions, $F(1,44) = 9.02$, $p = .004$, $\eta p^2 = .17$, $BF_{10} = 7.55$, with better Fluency in the Experimental condition. No main effect with anecdotal evidence was found for Section, $F(3,132) = 2.04$, $p = .11$, $BF_{10} = 0.34$. Finally, no interaction with anecdotal evidence was seen between Section and Condition, $F(3,132) = 2.44$, $p = .16$, $BF_{10} = 0.68$.

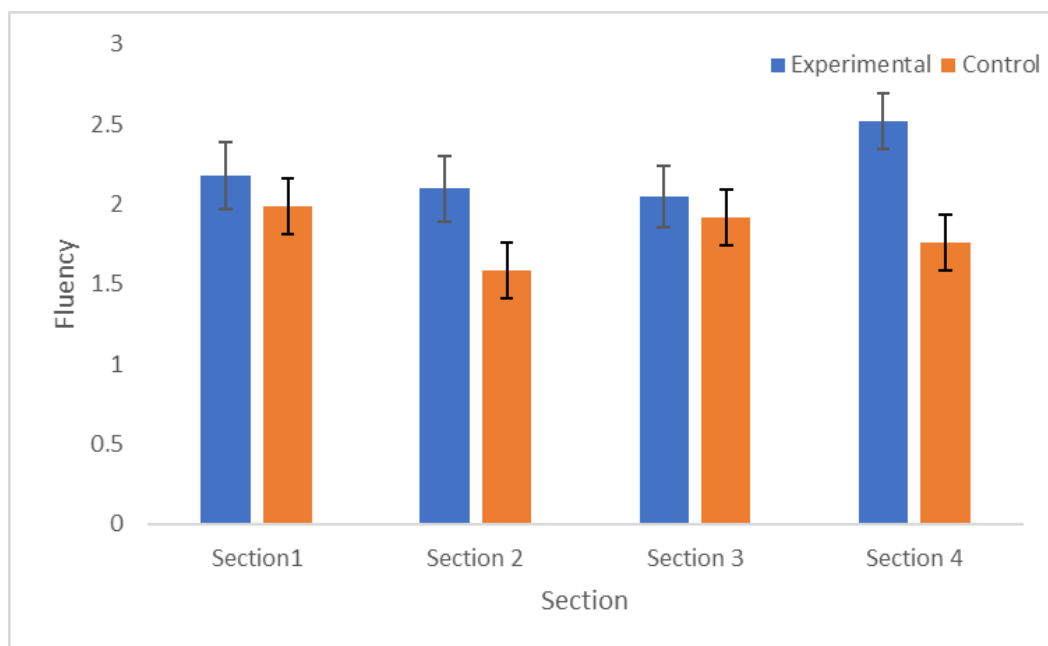


Figure 20. Graph depicting the differences in Fluency scores between Section and Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness Of CST Sorting Quadrants. A Pearson's Product Moment correlation was conducted to assess any relationship between Fluency and CST categories. No significant relationships were found; all $r_s < .39$, all $p_s > .07$. Subsequent Bayesian analysis indicated anecdotal evidence (all BF_{10} 0.26 – 0.57).

Flexibility

Frequentist Analysis. A mixed 2 x 4 ANOVA was conducted on AUT Flexibility scores (Figure 21); with within participant factor of Section (1, 2, 3, 4), and between participants factor, Condition (Experimental, Control). A main effect with only anecdotal support for the differences between Sections, $F(3,132) = 3.05$, $p = .03$, $\eta p^2 = .06$, $BF_{10} = 1.20$; however, although Section 1 had the highest Flexibility score, a Bonferroni post-hoc test revealed no differences between Sections (all $ps > .08$). In addition, there was a main effect with strong support for the differences between Conditions, $F(1,44) = 12.89$, $p = .001$, $\eta p^2 = .23$, $BF_{10} = 32.26$, with better Flexibility in the Experimental group. There was no interaction of these factors, although anecdotal evidence in support H_1 was seen; $F(3,132) = 2.06$, $p = .11$, $BF_{10} = 1.21$.

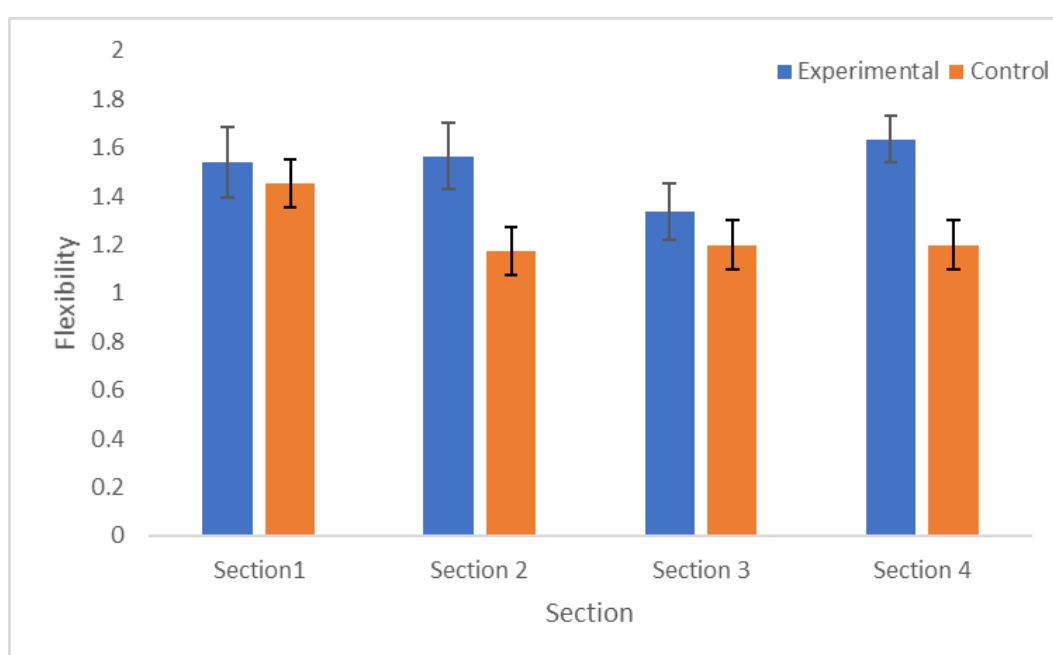


Figure 21. Graph depicting differences in Flexibility scores between Section and Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness Of CST Sorting Quadrants. A Pearson's Product Moment correlation was run to assess potential relationship between Flexibility and CST categories. No significant relationships were found; all $rs < .30$, all $ps > .17$. Subsequent Bayesian analysis indicated anecdotal evidence (all $BF_{10} 0.28 - 0.64$).

Elaboration

Frequentist Analysis. A mixed 2 x 4 ANOVA was conducted on AUT Elaboration scores (Figure 22), with within participant factor of Section (1, 2, 3, 4), and between participants factor of Condition (Experimental, Control). There was moderate support for a main effect of Condition, $F(1,44) = 8.15$, $p = .007$, $\eta^2 = .16$, $BF_{10} = 4.42$, with higher Elaboration scores in the Experimental condition. No main effect with Strong evidence indicates no difference between Sections, $F(3,132) = 0.24$, $p = .87$, $BF_{10} = 0.03$. Finally, very strong evidence indicates Section and Condition did not interact, $F(3,132) = 0.35$, $p = .79$, $BF_{10} = 0.01$.

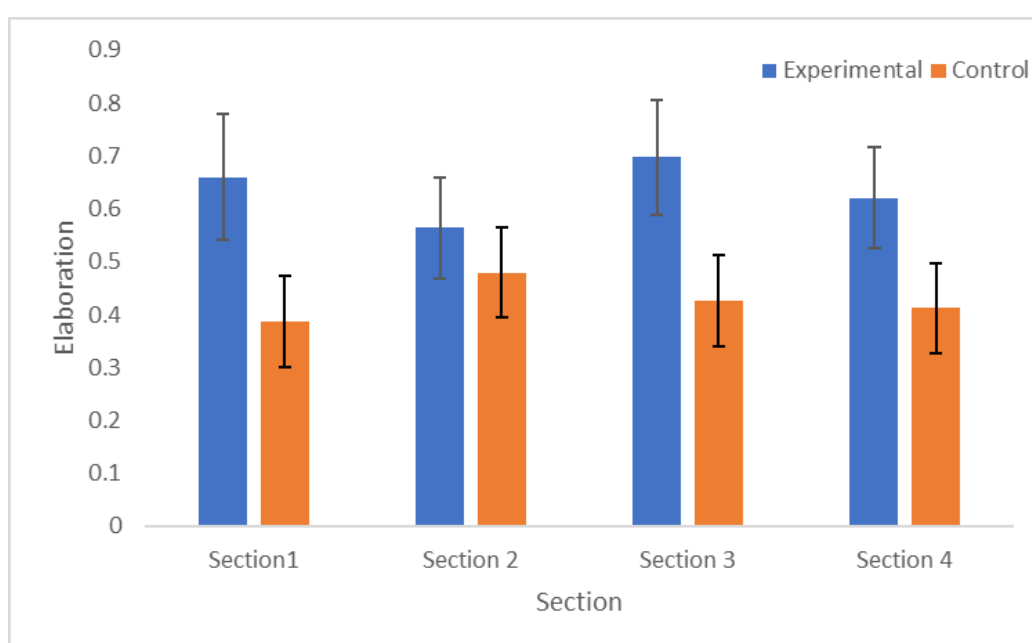


Figure 22. Graph depicting differences in Elaboration scores between Section and Conditions. Error bars indicate ± 1 standard error of the mean.

Predictiveness Of CST Sorting Quadrants. A Pearson's Product Moment correlation was conducted to explore any potential relationship between Elaboration and CST categories. No significant relationships were found; all r s $< .22$, all p s $> .30$. Subsequent Bayesian analysis suggested anecdotal evidence in support of the null hypothesis (all BF_{10} 0.27 – 0.43).

Originality

Frequentist Analysis. Similarly, a mixed 2 x 4 ANOVA was conducted on AUT Originality scores (Figure 23), with a within participant factor of Section (1, 2, 3, 4), and between participants factor of Condition (Experimental, Control). No effect was found for Condition, $F(3,132) = 0.55$, $p = .46$, $BF_{10} = 0.28$, or Section, $F(3,132) = 1.48$, $p = .22$, $BF_{10} = 0.11$, both received anecdotal evidence. No interaction was found between the factors with moderate evidence to support H_0 , $F(3,132) = 1.03$, $p = .32$, $BF_{10} = 0.03$.

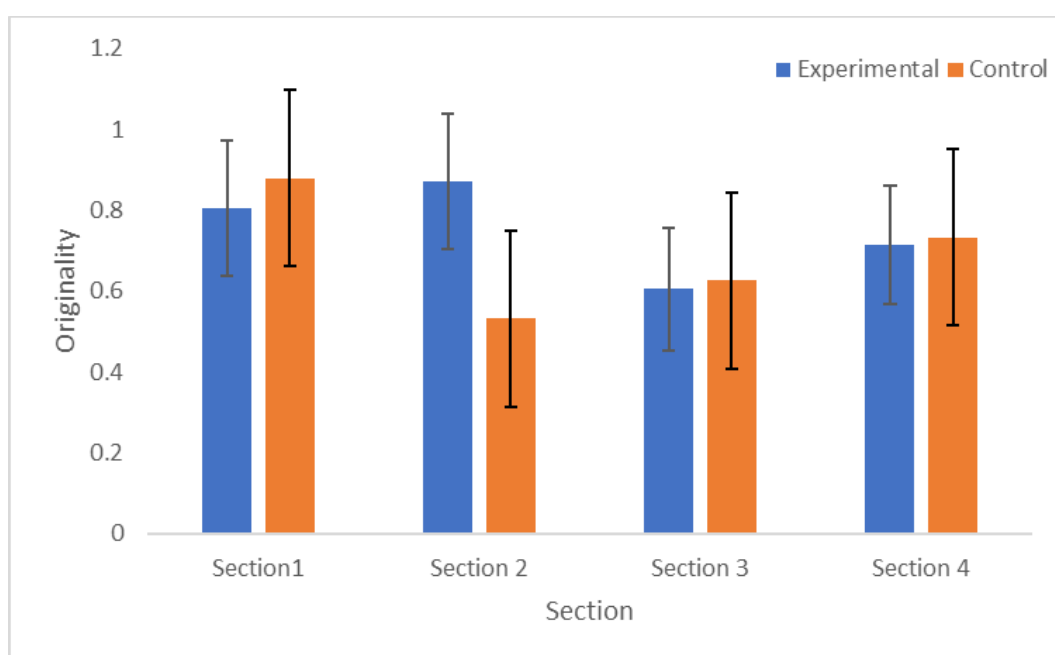


Figure 23. Graph depicting differences in Originality scores between Section and Conditions. Error bars indicate ± 1 standard error of the mean.

Predictiveness Of CST Sorting Quadrants. A Pearson's Product Moment correlation was conducted to assess any relationship between Originality and the CST quadrants. No significant relationships were found; all $r_s < .30$, all $p_s > .17$. Subsequent Bayesian analysis suggested anecdotal evidence in support of the null hypothesis (all BF_{10} 0.26 – 0.63).

Accuracy

Frequentist Analysis. A mixed 2 x 4 ANOVA was conducted on AUT Accuracy (%; Figure 24) with within participant factor of Section (1, 2, 3, 4), and

between participants factor of Condition (Experimental, Control). There was a main effect with extreme evidence in support of Section, $F(3,132) = 7.25$, $p = <.001$, $\eta p^2 = .14$, $BF_{10} = 115.90$; post-hoc Bonferroni analysis revealed fewer errors in Section 1 ($m = 20.82\%$), than Section 2 ($m = 30.81\%$, $p = .03$), Section 3 ($m = 32.79\%$, $p = .003$), and Section 4 ($m = 35.11\%$, $p = <.001$). No other differences were found (all $ps = 1.00$). There was also a main effect with moderate support for Condition, $F(1,44) = 8.70$, $p = .005$, $\eta p^2 = .17$, $BF_{10} = 7.74$, with lower error rates in the Experimental condition. No interaction with anecdotal evidence was found, $F(3,132) = 1.57$, $p = .20$, $BF_{10} = 1.07$.

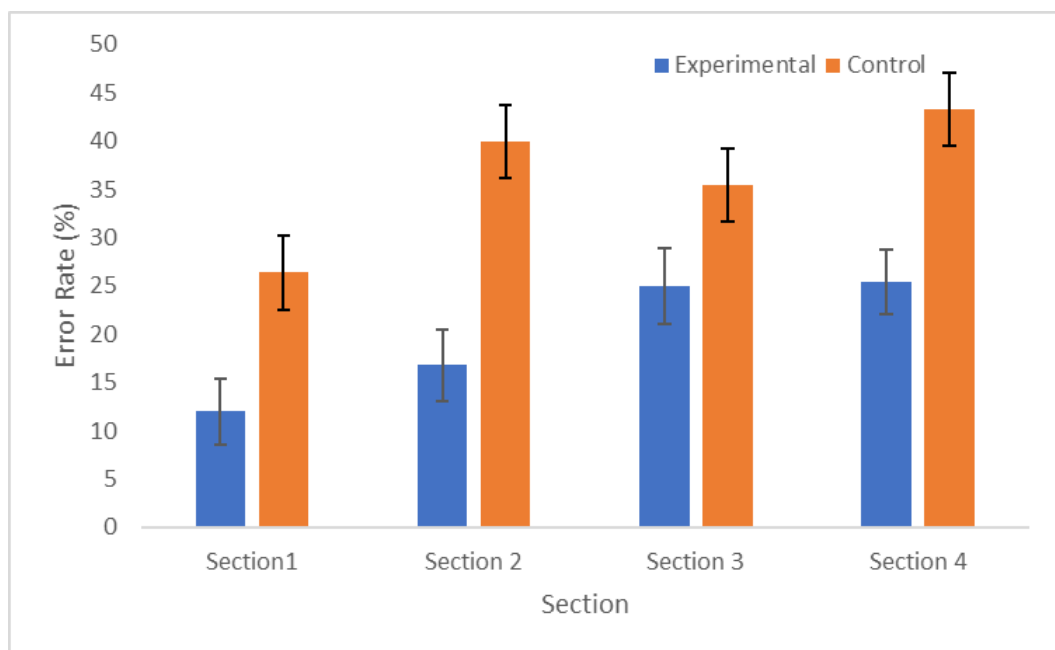


Figure 24. Graph depicting Error Rates (%) between Conditions by Section. Error bars indicate ± 1 standard error of the mean.

Predictiveness Of CST Sorting Quadrants. A Pearson's Product Moment correlation was run to assess the relationship between Error Rate and the CST categories. No significant relationships were found; all $rs < .355$, all $ps > .097$. Subsequent Bayesian analysis suggested anecdotal evidence in support of the null hypothesis (all $BF_{10} 0.26 - 0.95$).

Qualitative Data

Participants' responses to the free response questionnaires were analysed using a Content Analysis methodology as in Study 1 (see *Study 1: Qualitative Data*). A 'top-down' approach was adopted to address two specific questions: "how do participants feel about the CST?", and "what, if any, connection do participants perceive between the CST and the AUT?". Similarly to the caveat presented in Study 2, while the content analysis here was conducted following standardised procedures, findings from Studies 1 and 2 use of the CST have influenced (or are highly likely to have influenced) this analysis. On a pragmatic level, categories identified in previous analyses do not constrain this analysis (i.e., new, previously undefined categories have been used), but where similarities have occurred, this has been noted (e.g., via identical category names).

Connection Between the Tasks. In considering what, if any, connection participants perceive between the CST and the AUT, four distinct categories were identified: 1) Impactful, 2) No connection, 3) Harmful, and 4) Control Harmful (see Table 20 below). The most representative category for Experimental participants was that CST had a beneficial (i.e., Impactful) influence on the AUT, enhancing creativity in task performance. While noticeably less common, the CST was also identified by some as *Harmful* to performance. However, this is not to say that CST limited AUT performance per se, but that perceived lack of specific strengths (i.e., Creativity) identified in the CST subsequently impaired performance. Finally, the Control task was also identified as inhibiting AUT performance. Here, being able to flexibly switch between tasks was considered too difficult.

Table 20. Examples from each sub-category relating to the Connection between the tasks category.

Sub-category	Example
Impactful	<i>"The card sorting task made me think about all the things I had listed as a strength to make sure I was going by that so I could prove I had those attributes"</i>
No Connection	<i>"I forgot about the card sorting task and was driven to think of new out of the box uses for the objects"</i>
Harmful	<i>"I also noticed that I was not creative, and I was thinking about this as I completed the second task, so this may have made me think of less uses for objects, as I did not believe I was creative enough to do so."</i>
Control Harmful	<i>"I went from a relatively simple task, to a relatively demanding one, meaning I was used to order and function, but then I had to think outside the box"</i>

Character Strengths Reflection. One overarching Positivity category was identified for subjective CST experience. As with Study 2, two sub-categories emerged from the data; 1) Focus on Strengths, and 2) Overcoming Weaknesses (see Table 21 below). Generally speaking, the CST was considered a pleasant activity, with the majority of participants highlighting benefits of reflecting on personal strengths. Interestingly, a smaller (but meaningful) portion of the responses highlighted a focus on weaknesses; however, this was in the context of a goal (i.e., to work on or overcome).

Table 21. Examples of Sub-Categories relating to Reflection on Character Strengths Category.

Sub-category	Example
Focus on Strengths	<i>“it also made me think about the many strengths I feel I have and therefore this task has given me a quite positive outlook”</i>
Overcoming Weaknesses	<i>“The card sorting task was quite eye opening when finding cards which I felt were a weakness but would like them to be a strength”</i>

Discussion

Examining the quantitative data first, strong support for the main hypothesis was found. Specifically, participants undertaking the strengths-based CST performed better on the AUT, compared to a control. Participants produced more alternative uses with fewer errors, across wider categories of uses (i.e., flexibility) and higher levels of elaboration. Notably, this did not apply to the originality measure, however, this could be attributable to either a lack of CST impact on this specific factor or a result of compression at the lower end of the score range (i.e., the sample size meant it was difficult to achieve high originality scores- and the overall range reflected this). In addition, CST behaviour (i.e., distribution of cards into categories) was not a predictor of AUT performance. Overall, while there is some evidence for impact on CF is seen, subjective CST differences appear to have little influence. Bayesian analysis provided interesting insight, where main effects were found Bayesian analysis was generally confirmatory, suggesting sufficient evidence was available to support the differences, particularly relevant when comparing the effects of both card tasks. Simply, both types of analyses suggest the CST had a beneficial impact on participant CF as measured by the AUT (c.f. Originality).

An interesting outcome from the content analysis is increased homogeneity in categories; participants’ responses were more consistent, suggesting similar experience during the task. Further, beyond a general

expression of positive experience, participants indicate reflection on strengths to be beneficial, with increased sense of wellbeing and motivation. However, less substantial differences in experience are also of interest. Some participants appear to focus more on negative connotations of strengths (i.e., if it is not a strength it must be a weakness). Potentially, this may be driven by the inclusion of a Weakness category in the sorting procedure, however this influence has not been tested.

Overall, there is general support for CST efficacy; the activity is generally experienced positively, and Experimental participants are more creative; in terms of this paradigm, demonstrating higher levels of CF. However, while the subjective experience data offers important insight, it also raises questions about the design of the CST as an intervention. Indeed, when CST data is considered across all three paradigms in Studies 1-3, support for its effectiveness could be considered somewhat lacking, due to the inconsistent (and unpredictable) ways in which participants engage.

CST: Reviewing the Evidence

Statistical evidence for a difference between the Experimental and Control conditions in Study 3 provides an increased level of support for the overarching questions posed in this thesis. Specifically, this indicates that behavioural BBH benefit can be elicited via positive individual differences (i.e., character strengths), rather than positive affect only. However, the question of intervention robustness has emerged consistently as Studies 1-3 are compared, and given prior evaluation of the cognitive tasks used, we need to turn our attention to the intervention we adopt.

Speaking more generally, the qualitative results from Study 3 provide an interesting direction for future research. Control participants typically experienced their task to be negative or neutral, whereas Experimental participants reported a positive experience. Moving forwards, a more positive and focused intervention may be required to fully explore this relationship.

Comparing with the most directly-applicable literature (i.e., Fredrickson and Branigan, 2005; see specifically enhanced T-AR), it appears that the CF required in AUT performance aligns more effectively with what we would expect with BBH. In other words, the AUT may actively engage the T-AR of participants (i.e., unlike the NT and ACT), which enables a 'clearer view' of the impact of strengths-based intervention to emerge. In contrast, the more concrete tasks (e.g., NT, Navon, 1976; ACT, Irons & Leber, 2015) from Studies 1-2 may require a different form of CF or indeed, not engage the CF characteristic of enhanced T-AR at all. Obviously, this would be observed as a lack of consistent intervention impact. Thus, as a whole Studies 1-3 may indicate a less domain-general enhancement than originally conceptualized in either the BBH or CF literatures, emerging in more domain-specific contexts, perhaps interacting with task demands and/or the precise nature of the type of CF required for successful performance.

Chapter 5: Exploring a Goal-Oriented Intervention and Cognitive Flexibility in a Navon Task

Learning from the CST

Overall, findings from the CST quasi-intervention (Studies 1-3) were largely inconclusive. This can be summarized as 1) an absence of clear statistical differences between control and experimental groups across the studies (especially where task demand was low, in terms of higher order cognition / CF), and outstanding questions regarding intervention effectiveness raised by the qualitative data (e.g., CST breadth of application, participant fixation on weaknesses rather than strengths, etc.). Conversely, the arguably more demanding (at least in terms of creativity and novel thinking) AUT task offered clearer insight into Positive Psychology (PP) -based intervention (e.g., increased fluency). This indicated that character strengths may act similarly to positive affect in supporting improved cognitive performance (e.g., see BBH; Chapter 1). Further, the qualitative data highlighted a more focused, less negative experience when cognitive tasks were more demanding. Interestingly, the qualitative data also indicated that the implicit nature of the CST may have been a limitation on its efficacy. This suggests two possibilities; first, that any character strengths-based intervention used here will need more focus and specificity to work effectively. And/or second, that a passive and implicit intervention delivery may preclude impact on subsequent CF-based tasks.

Taken as a whole, the lack of firm conclusions does not negate potential behavioural benefits of character strengths in relation to BBH operation (e.g., as a source of positivity). The following studies (Studies 4-6) will explore this 'potential' by focusing on a specific character strength; hope. As detailed in Chapter 1, hope (represented behaviourally as goal planning and attainment) has been demonstrated as an effective strength to build PP interventions on (e.g., Cheavens et al., 2006; Klausner et al., 1998; Pedrotti et al., 2008). In particular, a brief goal-oriented intervention

(a goal-reflection task; GRT) will be used alongside the same (or similar) paradigms as before. In turn, this may help to address the issues of needing a stronger (and more targeted) positive intervention.

Methodological Changes

Explicit vs Implicit Goal-Orientation

Most interventions / reflective activities in a variety of contexts (e.g., meditation, education; see Walsh & Shapiro, 2006 for a review) require purposeful engagement, with participant awareness of aims and potential outcomes. Further, previous evaluation of hope interventions suggests a more 'direct' connection increase efficacy (see e.g., Weis & Speridakos, 2011). Thus, in addition to the experimental and control conditions from Studies 1-3, a third *explicit* (i.e., instructionally explicit) condition will be included here.

The importance of direct vs indirect instruction is also indicated by the subjective experience of CST participants, who cited a lack of specificity as a limitation of the task) and the goal-related literature (e.g., Latham, Stajkovic, and Locke; 2010). In the latter, a behavioural distinction between sub- and supraliminal priming has suggested the emergence of goals outside conscious awareness. Therefore, inclusion of a condition where the intervention purpose/aims are made clear to participants will enable comparison between the two instruction types. In addition, this will enhance the ecological validity of the intervention, given that individuals may seek out similar positivity-boosting support in real-world settings (e.g., meditation, mindfulness activities; Moore & Malinowski, 2009). In summary, we can ask the question; do those who engage in an intervention, knowing the intended outcomes, benefit more from the intervention?

Targeted intervention- The Goal Reflection Task (GRT)

Prima facie, this brief intervention was designed to address limitations of the CST²² discussed above. This task requires participants to reflect on achievement of a specific goal and associated behaviour (i.e., affect, cognitions, actions). In addition, a simple task engagement procedure is included, recording numbers of words written by participants. Previous studies (e.g., Morisano et al., 2010) have suggested this as an appropriate measure of engagement, specifically when relating positivity with achievement (here, academic attainment).

Revision of the Questionnaire Battery

Given the change to a more targeted intervention (i.e., examining only hope), closer examination of this component is needed. Two hope scales (state; SHS, and trait, THS hope; see Chapter 1, and below) will be included to measure hope pre- and-post intervention. In keeping with the MM philosophy (see *Chapter 3*), this allows for convergence of different data types. The GRT itself is qualitative, and resulting data gives insight into the subjective experience and impact of the reflective activity²³. However, the inclusion of hope and general affect questionnaires (e.g., PANAS; Watson et al., 1988) provides a more objective measure, and captures any changes in hope as a result of the intervention.

Adapting the Free Response Questionnaire

As the GRT may elicit deeper reflective activity (i.e., than the CST), the free response questionnaire requires alignment with the new task (see *Materials* below). Three prompts encourage participants to, 1) reflect on the task overall, 2) consider the reflective activity per se, and 3)

²² Pilot studies were conducted to check the most effective methodology for this intervention, including format and content of questions/prompts

²³ The GRT was piloted ($n = 10$) for the purpose of refining question and prompt format. For example, an iteration of “Please describe the goal you wanted to achieve” was “Please describe a previous goal”, which elicited vague reflections; participants suggested this was too broad.

predict/discuss any expected cognitive or behavioural changes as a result of the task. Similarly to Studies 1-3, this allows data from subjective experience to be considered alongside quantitative data, in addition to evaluation of the new intervention.

The Current Study: Research Questions and Predictions

The primary aim is to explore how effectively hope is able to operationalise BBH, via a goal-oriented intervention. Moreover, this study also seeks to evaluate the efficacy of the new intervention in conjunction with cognitive performance. Thus, we can ask simply whether GRT participants perform better on the CF-based task (here, the Navon Task; NT) than control counterparts? And, if performance differences emerge, does instruction format (Explicit or Implicit) have any impact?

As improving hope is the focus of the GRT, it is important to evaluate this in relation to the new intervention. Primarily, it is expected that participants undertaking the GRT will show increased levels of hope, whereas the control group will not. GRT engagement measures (number of words written) may also show a relationship between increased engagement (i.e., more words, and therefore more time and effort reflecting) and increased hope. These two aspects will be combined to assess whether participants who engage more fully in the GRT also show better NT performance. Similar uses of hope, previously focusing on positive affect and the BBH (e.g., Ciarrochi et al, 2015; see Alarcon et al, 2013), suggest that we should see both increased levels of hope (post intervention) and behavioural benefit to CF performance (defined in the NT by RT and Accuracy). Participant knowledge of these aims and predictions (e.g., Latham, Stajkovic, and Locke; 2010; see Weis & Speridakos, 2011) suggests that this will not hinder increased hopefulness (or subsequent CF performance), and may, in fact, boost it.

Overall, the qualitative data will allow insight into subjective experience of the GRT. A content analysis will enable evaluation of the

practice of goal -reflection itself, and potentially validate any applied real-world value of the intervention. In other words, evaluation of this intervention will not only indicate if it ‘works’, but also show whether it is an activity that participants enjoy, and/or would continue of their own accord.

Method

Participants

Seventy-eight participants were recruited (48 female); with age ranging from 18-25 ($M = 19.41$, $SD = 1.76$). Fifty-four participants self-reported their first language as English (69.2%), three as Cantonese, Mandarin, and Hindi (3.8% each), two as Spanish, Malay, and Polish (2.6% each); the remainder reported Urdu, Bahasa Indonesian, Chinese, French, Romanian, Bulgarian, Punjabi, Lithuanian, and Tamil (1.3% each). Participants were recruited from a panel of first year undergraduate psychology students at the University of Warwick, who each received course credit for their participation, or from University of Warwick volunteers, paid £6 for their participation.

Measures and Stimuli

Goal Reflection Task (GRT). This task required participants to describe and reflect on a goal they had previously achieved (see *Procedure* below). Participants were presented with a series of questions/statements to which they were asked to respond, as displayed in Table 22 below. In the control condition, participants were asked to describe and reflect on their ‘typical day’, and presented with a similar series of questions/statements. Participants were instructed to provide as much detail as they wanted to, without being given an explicit time limitation.

Table 22. Questions presented to participants in the GRT, and equivalent control ‘typical day’ task

GRT	1	<i>“Please describe the goal you wanted to achieve”</i>
	2	<i>“Why did you want to achieve this goal? Describe any reasoning or justifications behind it”</i>
	3	<i>“Please describe any obstacles which you overcame in order to reach the goal, thinking about what you originally planned, any issues that developed and how you dealt with them”</i>
	4	<i>“Finally, reflect on how it felt to achieve the goal at the time, and how you feel now describing and thinking about it”</i>
Control task	1	<i>“Please describe your typical day, providing details on things or activities that you would normally engage in”</i>
	2	<i>“Please add any extra information or details about your typical day that you might consider relevant”</i>
	3	<i>“Finally, reflect on how it feels to think about a day that you would typically have”.</i>

Navon Task. An identical NT procedure was used to that in Study 1. More details of the rationale for use of this paradigm are included in the overview of the methodological issues for this thesis (see *Chapter 3*).

Questionnaire Battery

State Hope Scale (SHS). The SHS (Snyder et al, 1994) was used to measure state hope. This scale consists of six statements, for which participants indicate how true these statements are, based on how they feel at that time. The scale runs from 1 (*Definitely False*) to 8 (*Definitely true*) and includes such questions as ‘*There are lots of ways around any problem that I am facing now*’ and ‘*At the present time, I am energetically pursuing my goals*’.

Trait Hope Scale. The THS (Snyder et al., 1991) was used to measure trait hope. This scale consists of twelve statements, with participants asked to indicate how true these statements were, based on

how they felt at that time. Again, this measure used an 8-point Likert scale (1=*Definitely False* to 8= *Definitely true*) and included questions such as '*I energetically pursue my goals*' and '*I meet the goals that I set for myself*'.

Positive and Negative Affect Schedule (PANAS). The PANAS (Watson et al., 1988) was used to measure participant mood at both Time 1 (i.e., before the NT) and Time 2 (i.e., after the NT). This scale consisted of 20 words (e.g., *Interested, Alert, Afraid*), and participants were asked to indicate the extent to which they 'felt' this term at that point in time (i.e., 1= *very slightly*, to 5= *extremely*). Two values were calculated from the questionnaire, a positive score (PP), and a negative score (PN).

Free-Response Questionnaire. To assess participant experience of the GRT, qualitative data were collected via a free-response questionnaire. Participants were prompted with three questions; 1) "*How did it feel to think about and reflect on a goal you have previous achieved?*", 2) "*Do you think reflecting on times when you successfully completed a goal will help you achieve goals in the future? If so, why?*", and 3) "*Please share any thoughts or idea you might have about the task in general*". Participants in the Control condition were also asked question 3, in addition to an amended question 1 (i.e., "*How did it feel to think about and reflect on a typical day*"). Participants were able to provide as much detail/feedback as they chose, without an explicit time limitation.

Design

A MM design was used for this study. For the experimental aspect (i.e., GRT effect on task performance), a 3 x 2 x 2 mixed factorial design was used. The between-participants factor was Instructional Condition (Implicit, Explicit, and Control), and within-participants factors were Perceptual Level (Global, Local; i.e., targets were either the global or local letter component of the stimulus; see Figure 25 below) and Response type (Normal, Changed; i.e., response keys of F and H, or D and J). Dependant variables were Reaction Time (RT) and Accuracy (error rates, %). For the

observational element (i.e., exploration of GRT-related behaviour), engagement was measured by the number of words written by the participant. All questionnaires were completed twice, once before completing the GRT (T1), and once after finishing the CF task (T2).

For the qualitative component of the study, the free-response questionnaire was administered to all participants. These data were collected to address two specific questions; 1) *what connection, if any, do participants discern between the GRT and the NT?* And 2) *how do participants experience the GRT and reflection on goal achievement?*

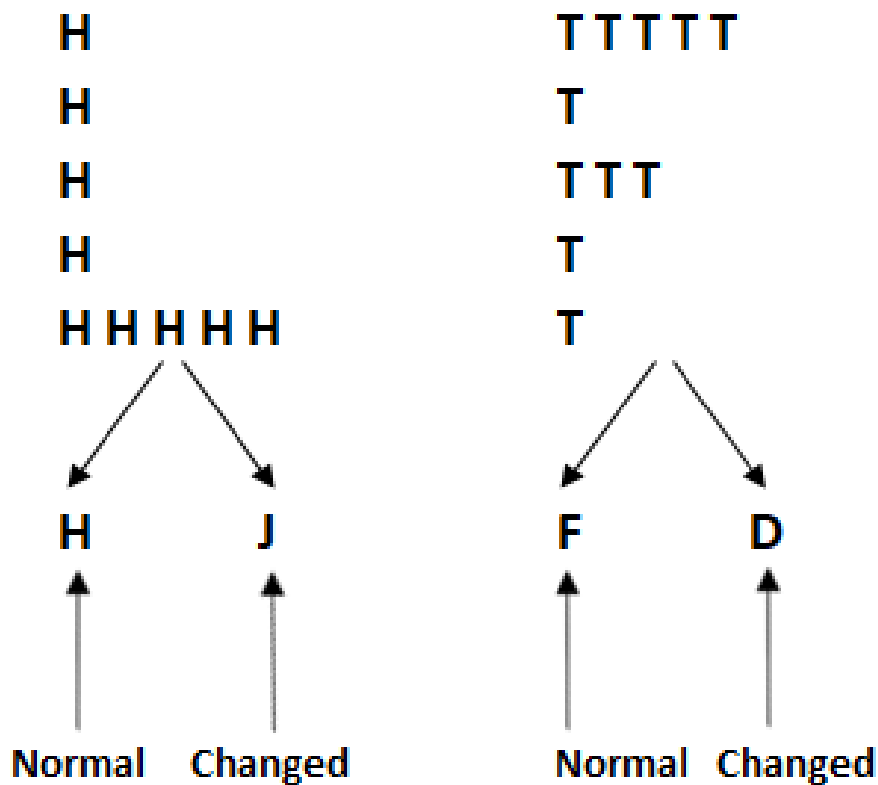


Figure 25. Example of a typical NT trial for both target letters, with the changes in response alignment.

Procedure

Participants were randomly allocated to one of the Instructional Conditions (Experimental-Implicit, Experimental-Explicit, or Control) and

were given an information sheet, before fully informed consent was sought. Testing took place in individual sound-attenuated laboratory cubicles. To begin, all participants completed the SHS, THS, and PANAS (T1). Detailed instructions (see Stimuli & Measures section above) were then provided for either the GRT (i.e., Implicit, Explicit), or typical day (i.e., Control) task.

GRT Procedure. In the Implicit instructional condition, participants were given an instruction sheet for the GRT, where they were asked to reflect on a goal they had previously achieved. No parameters for the goal were indicated, simply that it should be meaningful to the participant *and* had been achieved. Completion of the GRT was self-paced, and undertaken alone, with instructions to inform the researcher when finished. The Explicit instructional condition was identical to the Implicit condition, with one additional step. Before starting the GRT, participants were informed (by the researcher using a script) why they were being asked to complete the GRT, and what the expected outcomes were (e.g., increased hope, better performance on the subsequent NT). In the Control condition, participants were given instructions for the typical day task, where they were asked to describe what they would consider to be a typical day. Similarly, once instructed, task performance was self-paced in isolation, with instructions to inform the researcher when finished.

NT Procedure. Please note the procedure for the NT was identical to Study 1. Following completion of the reflective task, participants were instructed regarding the NT. As shown in Figure 25, they were informed verbally, that for each trial, a large capital letter (formed from smaller capital letters) would be presented, and they should indicate whether an 'F' or 'H' was present (at either global or local level) by a key press corresponding to the letter presented. Participants were instructed that an 'F' or 'H' would always be presented (but never within the same trial), and requested to perform the task as quickly, but as accurately, as possible. Participants were also informed that they would need to change the

response keys every eight trials (F to D, H to J). They were instructed that no external indication for this change would occur, and they would need to track and change the response keys autonomously. Participants were given opportunity to clarify task instructions at this point, then undertook a brief practice block (16 trials, eight for each response type).

Upon completion of the NT, participants were given the SHS, THS, and PANAS again (T2), plus the free-response questionnaire. Here, they were asked to reflect on the study as a whole, and describe any thoughts or feelings that occurred to them at any point. In particular, participants were asked to comment on their experience of the GRT, and any resulting thoughts and/or feelings that arose.

Following data collection, Frequentist analyses were conducted using SPSS (IBM Corporation, 2016). Bayesian statistical analyses were also conducted, using the free software JASP (version 0.9.0.1) and default priors (JASP Team, 2017, see *Chapter 3: Bayesian Analysis*). Free-response data were collated using nVivo (QSR International Pty Ltd, 2012), and analysed using a content analysis methodology (Hsieh & Shannon, 2005; Mayring, 2000).

Results

In order to simplify the structure of the findings, this section has been divided into two sections: quantitative and qualitative data. Firstly, descriptive statistics are outlined, followed by the questionnaires and experimental data (i.e., descriptive statistics for the NT, and subsequent inferential analyses). Note, Bayesian analysis is reported with NT data, to ensure a full and robust statistical approach to data²⁴ analysis. Second, qualitative data are explored using Content Analysis (Hsieh & Shannon, 2005), with textual presentation of the findings.

²⁴ Both in terms of experimental power and avoidance of Type 1 error, due to the number of analyses required by a complex design. Analysis of Effects are reported as BF_{inc} , and BF_{10} for correlational analyses.

Reflective Tasks

Descriptive Statistics. Table 23 shows the mean number of words written by participants; grand mean and then by item²⁵. Participants in the Implicit condition wrote the most words ($m = 61.89$, $SD = 34.54$), while those in the Explicit conditions generally wrote the least ($m = 47.67$, $SD = 31.45$); dispersion was substantial (collapsed mean across all conditions $m = 53.00$, $SD = 39.76$), but similar across all groups.

Table 23. Mean number of words written by participants by Condition

	Implicit		Explicit		Control	
	Mean	SD	Mean	SD	Mean	SD
Grand mean	61.89	34.54	47.67	31.45	49.65	35.30
Q1	17.92	18.47	11.88	10.42	95.46	68.03
Q2	48.88	35.52	44.81	48.86	13.31	22.15
Q3	110.96	75.11	78.15	61.41	-	-
Q4	69.81	39.64	55.85	33.68	40.19	31.02

Inferential Statistics. No differences with anecdotal evidence for the null were seen in the average words written between Instructional Conditions as determined by a one-way ANOVA, $F(2, 77) = 1.35$, $p = 1.37$, $BF_{inc} = 0.32$.

Questionnaire Data

Descriptive Statistics. Participants completed each questionnaire at two time points, once before (T1) and once after (T2) the GRT and NT; the data are displayed in Table 24 below. Participants in the Implicit condition showed a general increase in ‘positivity’ between T1 and T2 (i.e., an increase in THS, $m = 2.00$; and a decrease in PN, $m = -2.62$). However notably, all instructional conditions decreased in positivity between T1 and

²⁵ Descriptive data for all questions reported in Table 24, although only the ‘overall’ figure will be used from this point forwards as a measure of GRT engagement.

T2 (i.e., overall decrease $m = -0.81$). In contrast, participants in the Control condition showed a general decrease in hope scores (i.e., THS differences; $m = -.077$), although they were also found to be less negative (i.e., PN difference; $m = -1.92$). Finally, and somewhat surprisingly, the Explicit condition had a more varied response, with small increases in THS and Pathway scores ($m = 0.19$, and $m = 0.46$ respectively) and small decreases in SHS and Agency ($m = -0.04$, and $m = -0.27$ respectively).

Table 24. Responses for SHS, THS (Agency/Pathway subscales) and PANAS (Positive/Negative subscales), by both Time Point and Condition

Questionnaire		Condition					
		Implicit		Control		Explicit	
		Mean	SD	Mean	SD	Mean	SD
T1	SHS	35.46	4.88	35.88	5.86	34.04	5.87
	PANAS Positive	34.04	6.53	32.62	7.98	31.04	9.54
	PANAS Negative	17.92	6.35	17.77	7.63	20.35	7.85
	THS	48.42	7.10	49.27	8.70	46.73	9.87
	THS Agency	23.77	4.29	24.31	5.00	22.58	6.25
	THS Pathway	24.65	3.71	24.96	4.28	24.15	4.51
T2	SHS	35.92	6.47	35.81	6.71	34.00	7.60
	PANAS Positive	33.35	8.61	31.54	10.67	30.38	10.84
	PANAS Negative	15.31	6.04	15.85	6.50	18.27	7.39
	THS	50.42	7.03	48.50	8.15	46.92	9.65
	THS Agency	24.77	4.01	23.85	4.51	22.31	5.70
	THS Pathway	25.65	3.72	24.65	4.14	24.62	4.77
Difference	SHS	0.46	3.66	-0.08	3.77	-0.04	4.07
	PANAS Positive	-0.69	4.08	-1.08	5.73	-0.65	4.87
	PANAS Negative	-2.62	3.10	-1.92	4.31	-2.08	3.71
	THS	2.00	3.11	-0.77	2.89	0.19	3.50
	THS Agency	1.00	1.86	-0.46	1.68	-0.27	2.39
	THS Pathway	1.00	1.77	-0.31	1.76	0.46	1.79

*N = 26 per Condition

Inferential Statistics

Difference Between Questionnaire Score at T1 And T2. A mixed 2x3 ANOVA was conducted on the questionnaire data, with a within-participant factor of Time (T1, T2), and a between-participants factor of Instructional Condition (Implicit, Explicit, and Control); results are displayed in Table 25 below and differences between T1 and T2 are depicted in Figure 26.

For PN, a main effect with extreme evidence for an effect of Time was seen, $F(1,75) = 27.15$, $p < .001$, $\eta^2 = .27$, $BF_{inc} = 7079.08$; responses were lower at T2 (i.e., less negative) than T1. An interaction was found between THS and Condition, although evidence was only anecdotal, $F(2,75) = 5.10$, $p = .008$, $\eta^2 = .12$, $BF_{inc} = 2.03$; both GRT conditions (Implicit, Explicit) increased in THS by T2, although the Control condition decreased. An interaction was also seen between both THS subscales: Agency, $F(2,75) = 4.11$, $p = .02$, $\eta^2 = .10$, $BF_{inc} = 0.64$, and Pathway, $F(2,75) = 3.57$, $p = .03$, $\eta^2 = .09$, $BF_{inc} = 0.94$. While both GRT conditions also increased in Pathways between T1 and T2, only the Implicit condition had a higher Agency score at T2; however as evidence was anecdotally in support of the null hypothesis these interactions should be considered with caution. No other main effects or interactions were found (all $F_s < 3.67$, all $p_s > .06$).

Table 25. Mixed ANOVA results for differences between T1 and T2, by Instruction

Condition

Questionnaire	Effect	F	df	p	η^2	BF _{inc}
SHS	Time	0.07	1,75	.79	.00	0.15
	Condition	0.74	2,75	.48	.02	0.29
	Time *Condition	0.16	2,75	.85	.00	0.02
THS	Time	1.74	1,75	.19	.02	0.69
	Condition	0.70	2,75	.50	.02	0.92
	Time *Condition	5.10	2,75	.008**	.12	2.03
Agency	Time	0.16	1,75	.69	.00	0.26
	Condition	1.08	2,75	.35	.03	0.55
	Time *Condition	4.11	2,75	.02**	.10	0.64
Pathway	Time	3.67	1,75	.06	.05	0.82
	Condition	0.23	2,75	.80	.00	0.53
	Time *Condition	3.57	2,75	.03**	.09	0.94
PP	Time	2.09	1,75	.15	.03	0.31
	Condition	0.75	2,75	.48	.02	0.34
	Time *Condition	0.06	2,75	.94	.00	0.05
PN	Time	27.15	1,75	<.001**	.27	7079.08
	Condition	1.29	2,75	.28	.03	0.44
	Time *Condition	0.25	2,75	.78	.00	0.21

** = Significant effect <.005.

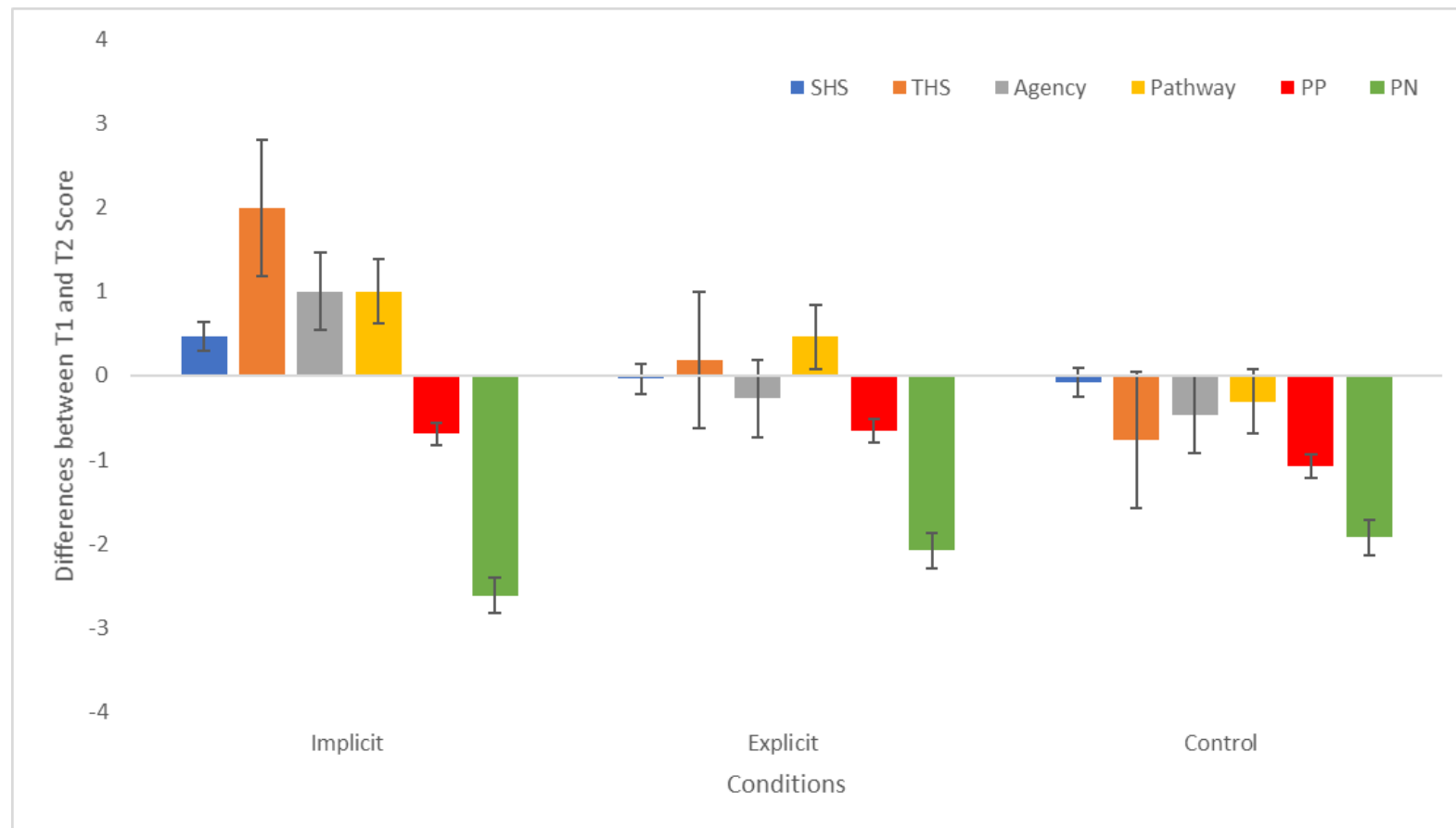


Figure 26. Graph depicting differences in Questionnaires scores between T1 and T2 by Condition. Error bars indicate ± 1 standard error of the mean.

GRT Relationship with Questionnaire Variables. A Pearson's Product Moment correlation was conducted to establish associations between questionnaire scores (at both T1 and T2) and GRT engagement (see Table 26 below). Where correlations were statistically significant, simple linear regression analyses were used to calculate predictiveness of GRT engagement on questionnaire responses (see Table 27 below). GRT engagement was a predictor of T2 THS, Agency, and Pathway scores (as shown in Figure 27 below), although evidence was only anecdotally in support of the alternative hypothesis (all BF_{10} 1.37 - 1.91).

Table 26. Correlational analyses between GRT engagement and questionnaires at T1 and T2

Time		Questionnaires					
		SHS	PP	PN	THS	Agency	Pathway
T1	<i>r</i>	0.12	-0.04	-0.07	0.19	0.18	0.17
	<i>p</i>	.29	.72	.54	.09	.12	.14
T2	<i>r</i>	0.11	0.01	-0.13	0.25*	0.23*	0.23*
	<i>p</i>	.35	.91	.27	.03	.05	.04

* = Significant < .05

Table 27. Regression analyses summary for GRT engagement predicting questionnaire scores at T2

Questionnaire	<i>t</i>	<i>p</i>	<i>R</i> ²	<i>B</i> ⁰	<i>B</i> ¹	<i>BF</i> ₁₀
THS	2.22	.03	.05	45.39	0.06	1.91
Agency	2.04	.05	.05	21.92	0.03	1.37
Pathway	2.05	.04	.05	23.47	0.03	1.42

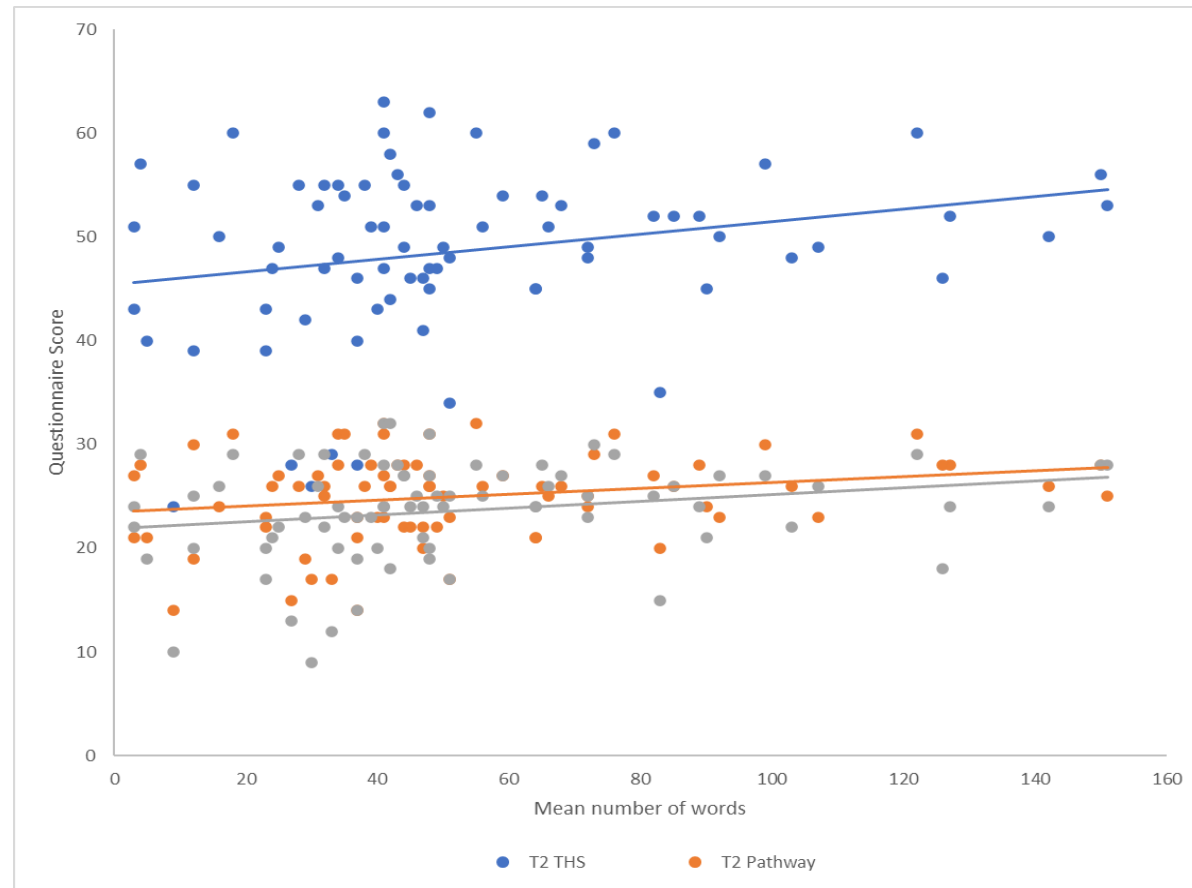


Figure 27. Scatterplot showing relationship between THS, Pathway, and Agency scores at T2, and mean number of words produced for the GRT.

NT Data

Screening was on pre-determined conservative ranges of <150ms to >5,000ms for RT, and Error Rate of > 15%; no outliers were removed from the data). Descriptive and Inferential statistics for Navon performance are below, followed by a short summary of each variable. As a whole, these descriptive data suggest the GRT conditions, regardless of instructional type, showed comparable performance, with the control condition slightly slower. Accuracy was approximately equivalent across conditions.

RT Descriptive Statistics. Across all factors, RTs for the Implicit condition were faster ($m = 1069.41\text{ms}$, $SD = 234.40$), followed by the Explicit condition ($m = 1088.23\text{ms}$, $SD = 249.40$), and finally, the Control condition ($m = 1220.25\text{ms}$, $SD = 402.59$). Across all factors, the Implicit condition had the fastest mean RT (Global Normal trials; $m = 975.61\text{ms}$, $SD = 194.04$), and the Control condition has the slowest mean RT (Local Changed trials; $m = 1290.07\text{ms}$, $SD = 545.24$).

Table 28. RTs in milliseconds (ms) for NT performance, by Perceptual Level, Response Type and Instructional Condition

Level	Response Type	Instructional Condition*					
		Implicit		Explicit		Control	
		Mean	SD	Mean	SD	Mean	SD
Global	Normal	1056.53	282.01	1057.65	248.82	1201.98	438.07
	Changed	975.61	194.04	1030.59	268.90	1113.93	374.24
	Global mean	1016.07	234.40	1044.12	249.40	1157.96	402.59
Local	Normal	1168.25	386.44	1158.45	292.69	1275.03	491.08
	Changed	1077.27	247.81	1106.21	334.10	1290.07	545.24
	Local mean	1122.76	308.42	1132.33	283.98	1282.55	497.31
Grand mean		1069.41	267.62	1088.23	259.56	1220.25	435.39

**N = 26 per Condition*

RT Frequentist Analysis. A mixed 2 x 2 x 3 ANOVA was conducted on NT RTs (Figure 28), with within-participant factors of Perceptual Level (Global, Local), Response Type (Changed, Normal), and a between participants factor of Instructional Condition (Implicit, Explicit, and Control). There was a significant main effect of Perceptual Level with extreme evidence that global trials were faster than local trials, $F(1,75) = 29.36$, $p < .001$, $\eta^2 = .28$, $BF_{inc} = 787385.14$. Similarly, a main effect of Response Type with moderate evidence was demonstrated, $F(1,75) = 11.15$, $p = .001$, $\eta^2 = .13$, $BF_{inc} = 5.07$, with Normal trials faster than Change trials. No difference was found between the conditions, with anecdotal support for the null, $F(1,75) = 1.60$, $p = .21$, $BF_{inc} = 0.29$. No other effects or interactions were found (all F s < 1.62 , all p s $> .20$); note the interactions between Perceptual Level and Condition ($BF_{inc} = 0.09$), and Perceptual level, Response Type, and Condition ($BF_{inc} = 0.003$) had very strong and extreme evidence (respectively) for the null hypothesis, suggesting these factors do not interact.

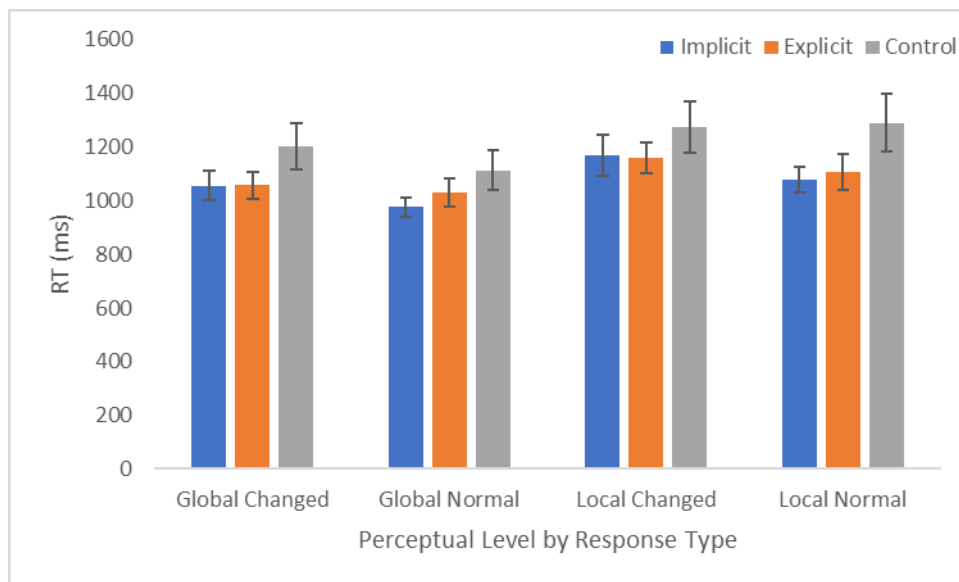


Figure 28. Graph showing RTs, between Perceptual Level and Response Type by Condition. Error bars indicate ± 1 standard error of the mean.

Table 29. Results of an ANOVA comparing RTs for Perceptual Level (PL), Response Types (RsT), and Condition, plus corresponding Bayes Factor

	<i>F</i>	<i>df</i>	<i>p</i>	ηp^2	BF _{inc}
PL	29.36	1, 75	<.001	.28	787385.14
RsT	11.15	1, 75	.001	.13	5.07
Condition	1.60	2, 75	.21	.04	0.29
PL * RsT	0.47	1, 75	.50	.01	0.41
PL * Condition	0.29	2, 75	.75	.01	0.09
RsT * Condition	0.98	2, 75	.38	.03	0.19
PL * RsT * Condition	1.50	2, 75	.23	.04	<0.01

Predictiveness of GRT. A Pearson's Product Moment correlation was conducted to assess any relationship between RT and the GRT engagement. No clear association was evident, with anecdotal evidence in support of the null; $r(78) .81, p = .48, BF_{10} = .25$. Therefore, no regression analyses were calculated.

Predictiveness of Questionnaires. Similarly, a series of Pearson's Product Moment correlations were conducted to assess any relationships between RT and hope questionnaires (at both T1 and T2; see Table 30 below). No relationship was found between RT and Agency at T1, and no relationships were found between RT and any T2 questionnaire variables; therefore these were not included in the regression analyses below.

*Table 30. Correlational analyses between questionnaires at T1 and T2, and RT
(overall and collapsed across Perceptual Level and Response Type)*

Time		Questionnaires			
		SHS	Agency	Pathway	THS
T1	<i>r</i>	0.26*	0.17	0.23*	0.23*
	<i>p</i>	.05	.10	.05	.05
T2	<i>r</i>	0.19	0.14	0.19	0.18
	<i>p</i>	.10	.23	.09	.12

* = significant <.05

For each significant correlation, a simple linear regression²⁶ was used to provide further details of the relationships (see Table 31 below). T1 SHS, Pathway, and THS were significant predictors of RT (see Figure 29 below). However, it is also important to note that, in each case, the variance accounted for was low (all R^2 s = < 0.05), and significance was achieved at a non-conservative level (all p s = < .05 and > .04). More, evidence for each relationship was only anecdotal (all BF_{10} 1.30 -1.40). Overall, this suggests a series of inconclusive findings, which should be taken with caution.

Table 31. Regression analyses summary for T1 questionnaire scores predicting RT, collapsed across Perceptual Level and Response Type

Questionnaire	<i>t</i>	<i>p</i>	R^2	B^0	B^1	BF_{10}
SHS	2.01	.05	.05	650.08	13.55	1.33
THS	2.00	.05	.05	708.34	8.68	1.30
Pathway	2.04	.05	.05	673.66	18.39	1.40

Note: unless stated otherwise, all assumptions were met. Regression equation details only reported for significant predictors.

²⁶ A multiple regression could not be used as the questionnaires were too highly correlated, violating statistical assumptions.

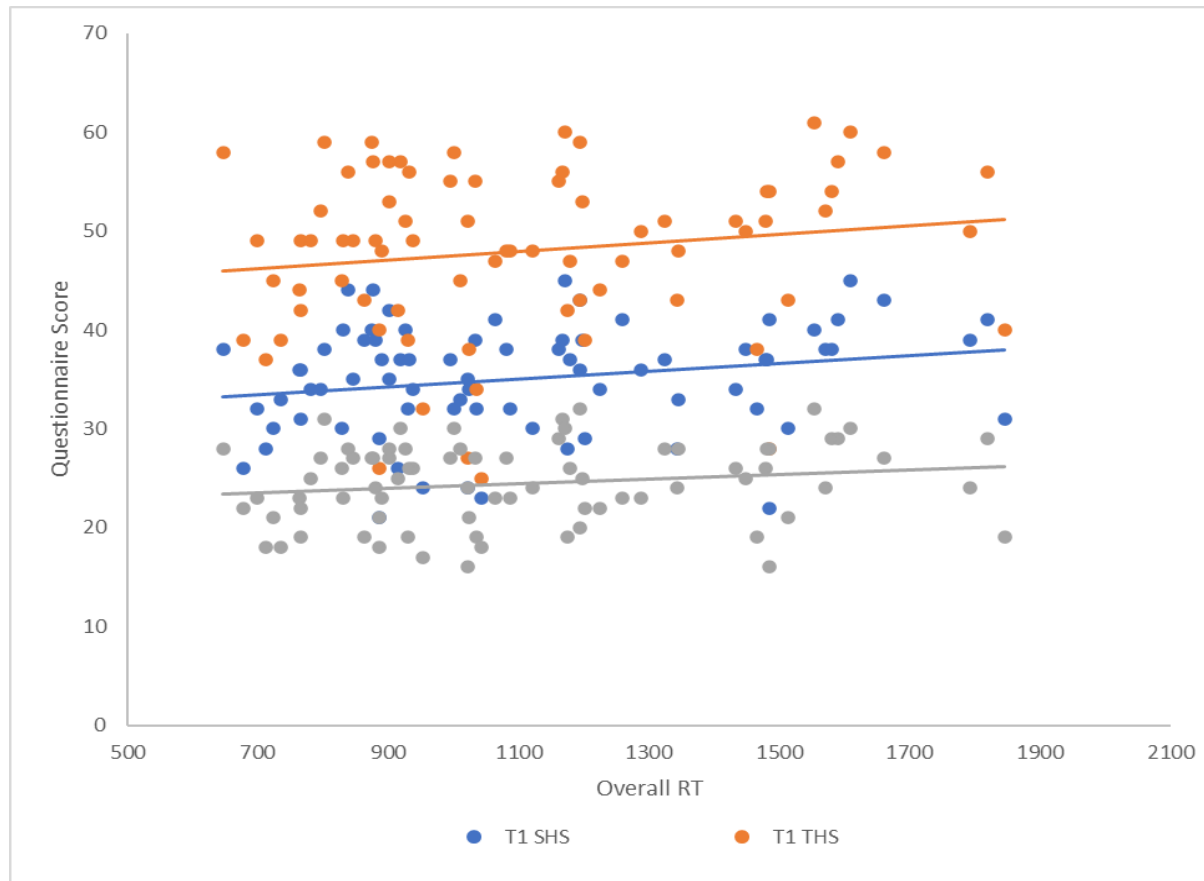


Figure 29. Scatterplot showing relationship between THS, Pathway, and SHS scores at T1, and RT.

Accuracy Descriptive Statistics. For all conditions, error rates were similar, with a minimal range (1.02%) from the most accurate (Implicit; $m = 96.27\%$, $SD = 3.15$) to least (Explicit; $m = 95.25\%$, $SD = 2.87$). Across all factors, the Explicit conditions had the lowest mean error rate (Local Changed trials; $m = 94.46\%$, $SD = 4.18$). In comparison the highest mean error rate was found in the Implicit condition (Global Changed trials; $m = 96.61\%$, $SD = 3.78$).

Table 32. Error rate in percentage (%) for NT performance, by Perceptual Level, Response Type and Condition

Level	Response Type	Instructional Condition*					
		Implicit		Explicit		Control	
		Mean	SD	Mean	SD	Mean	SD
Global	Normal	96.61	3.78	95.60	3.87	95.97	4.64
	Changed	96.47	3.26	95.92	2.74	95.92	5.17
	Global mean	96.54	3.12	95.76	2.97	95.95	4.64
Local	Normal	95.83	3.47	94.46	4.18	94.46	5.93
	Changed	96.15	3.95	95.01	3.16	95.28	5.20
	Local mean	95.99	3.57	94.73	3.20	94.87	5.17
Grand mean		96.27	3.15	95.25	2.87	95.41	4.74

* $N = 26$ per Condition

Accuracy Frequentist Analysis. An identical mixed $2 \times 2 \times 3$ ANOVA was conducted for Navon accuracy data (Figure 30). Within-participant factors comprised Perceptual Level (Global, Local) and Response Type (Changed, Normal); again, the between participants factor was Instructional Condition (Implicit, Explicit, Control). A main effect with Moderate evidence was found for Perceptual Level, $F(1,75) = 10.94$, $p = .001$, $\eta^2 = .13$, was shown, with higher accuracy in Global trials. No difference was found between the conditions, $F(1,75) = 0.58$, $p = .57$, $BF_{inc} = 0.12$ and no other effects or interactions reached significance (all $F_s < 1.65$, all $p_s > .20$). There was moderate evidence in support of the null for the Perceptual Level and Condition interaction ($BF_{inc} = 0.05$), and

extreme evidence to say that Response type and Condition do not interact ($BF_{inc} = 0.008$).

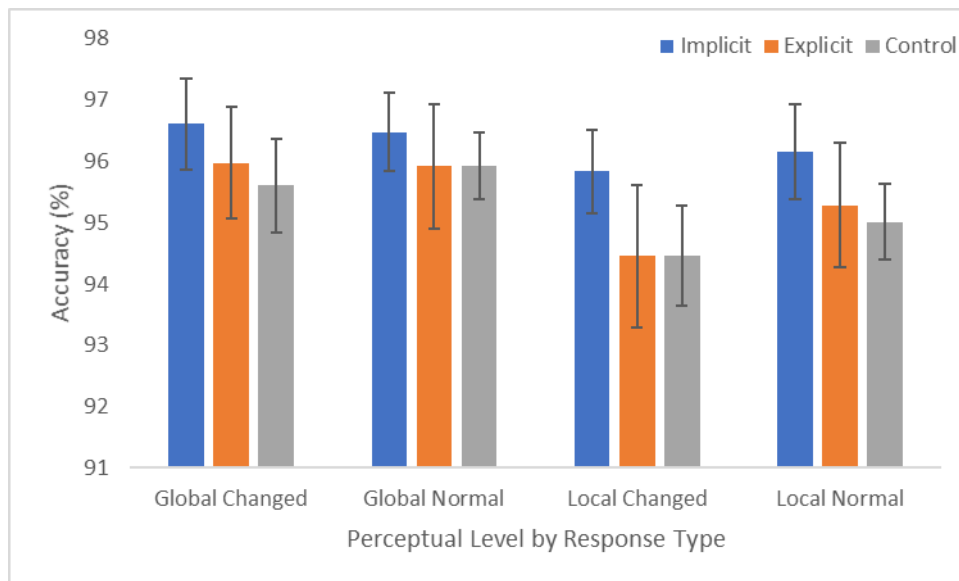


Figure 30. Graph showing Accuracy, between Perceptual Level and Response Type by Condition. Error bars indicate ± 1 standard error of the mean.

Table 33. Results of an ANOVA comparing Accuracy for Perceptual Level (PL), Response Types (RsT), and Condition

	<i>F</i>	<i>df</i>	<i>p</i>	ηp^2	BF_{inc}
PL	10.94	1, 75	.001	.13	9.01
RsT	1.09	1, 75	.30	.01	0.11
Condition	0.58	2, 75	.58	.02	0.12
PL * RsT	1.19	1, 75	.28	.02	0.11
PL * Condition	0.40	2, 75	.68	.01	0.05
RsT * Condition	0.14	2, 75	.87	.00	<0.01
PL * RsT * Condition	0.16	2, 75	.86	.00	1.62

Predictiveness of GRT. A Pearson's Product Moment correlation was conducted to assess any relationship between Accuracy and the GRT engagement. No relationship was found, $r(78) = .19$, $p = .09$, $BF_{10} = 0.55$, with

anecdotal evidence in support of the null hypothesis, therefore no regression analysis was calculated.

Predictiveness of Questionnaires. A series of Pearson Product Moment correlations were conducted to assess relationships between Accuracy and questionnaires at both T1 and T2 (i.e., prior to regression analyses) A small, negative correlation was found between Accuracy and T1 SHS ($r = -.25$, $p = .003$). No other relationships were found (all r s $< .22$, all p s $> .058$, BF_{10} 0.14 – 0.65). A simple linear regression showed T1 SHS was also predictive of Accuracy, $F(1, 77) = 4.90$, $p = .03$, $R^2 = .06$. The results suggest a positive relationship between lower SHS scores and higher accuracy, although as with RT the strength of this relationship is very limited. A Bayesian linear regression analysis provided anecdotal evidence in support of the alternative hypothesis ($BF_{10} = 1.90$), again suggesting that this relationship should be treated with caution.

Qualitative Data

Free-response Questionnaire. Participants' responses to the free response questionnaire were analysed using the same methodology as Studies 1-3. However here, questions were adapted slightly; rather than direct prompting a comment on GRT and NT connection, participants were asked to reflect on any impact the GRT they believed it may have had generally. As outlined previously (See Chapter 4), a top-down content analysis was conducted to address two questions, 1) how do participants feel about the GRT task? And 2) what (if any) impact do they think it may have?

Reflecting on a Goal. Example codes are displayed in Table 34 below. The most representative category (i.e., comprising most codes) highlighted the GRT as a positive experience. Sub-categories identified from the text included, increased awareness of previous accomplishments (i.e., previously forgotten), reflecting on success, and being a generally motivating exercise. Some negative experiences were also identified, with participants suggesting the GRT highlighted a lack of current direction/avenue for achievement, and concerns about current goal achievement. Finally, and notably, the control reflection

activity (see Methods above) also elicited a positive experience (e.g., participants enjoyed reflecting on their day). This suggested, at least on an anecdotal level, that more subjective and focused reflective activity (e.g., GRT) is more enjoyable for participants.

The 'Motivational' sub-category emphasized the positivity inherent in the GRT; specifically, participants reported feeling motivated by their own previous success. Interestingly, all items coded to the motivation sub-category emerged from Implicit condition data. Further, the 'Lack of Direction' sub-category was comprised entirely of Explicit condition data. While the remaining categories were more evenly represented by both groups, this may suggest that Implicit condition participants engaged with the task in a more meaningful way. Here, 'meaningful' could be aligned with a larger proportion of participants in the Implicit Condition responding with items coded within the 'Awareness of accomplishments' sub-category. In turn, this arguably indicates more profound reflection on their part. Alternatively, Explicit condition participants may have found the task a broadly positive experience, but trivial in context. This could be due to their awareness of GRT aims and expected patterns of behaviour.

Table 34. Examples of each of the Sub-Categories relating to the reflective tasks

Category	Sub-category	Example
Positive	Motivational	"It felt great to reflect on my past actions and achievements. This helped remind me to stay focused and determined"
	Successful Reflection	"It felt good to do this since I feel like usually once I have achieved something I get hung up over the next thing, rather than reflecting on what I have achieved"
	Awareness of accomplishments	"It felt a little fulfilling when remembering something that I had previously achieved as it brought this into realisation"
	Control condition	"It felt very therapeutic to be able to look back at my day and review my daily routine"
Neutral	No specific reaction	"I did not feel a particular way about this"
Negative	Lack of direction	"I feel like I haven't set or achieved many goals in my life and I was a bit difficult for me to think of one"
	Progression Concerns	"it made me stressed, but also made me realise that it's not as busy as I think"

Impact of GRT. In considering what, if any, impact of the GRT participants perceive, two categories emerge. The first is an influence on general behaviour (i.e., beyond the scope of the study), and the second is specific impact on NT performance. Regarding general behaviour, two sub-categories were identified (see Table 35). The majority of participants suggested behavioural benefit; specifically, they considered enhanced achievement of their goals moving forward. Interestingly, in a similar vein, data from the Explicit condition formed the majority of the 'No impact' sub-category entries. Arguably, this supports the speculation above; in other words, for participants in this condition, the task was

a broadly positive experience- albeit one that remained without personal relevance or meaning.

Table 35. Example of each sub-category relating to the impact of the GRT generally

Sub-category	Example
Impactful	“Yes because it adds motivation to me, since I am able to see the greatness in past achievements and experiences and see that I was able to overcome past struggles, which will help me to believe that I can overcome present struggles to achieve future goals”
No Impact	“No, it makes me more sad [SIC] and actually I feel very unmotivated to do anything right now”

For specific impact on NT performance, two sub-categories were also identified (see Table 36). Similarly to earlier patterns from Explicit condition participants, the ‘Detrimental’ sub-category (i.e., GRT elicited a performance decrement) was mainly seen from Explicit condition participants. Conversely, most Implicit condition participants indicated a performance benefit. Taken as a whole, these data illustrate that participants’ lived experience of the GRT (i.e., evident from the qualitative data) can diverge in both affect and cognition. Most striking perhaps, is its divergence from the quantitative data (i.e., where no behavioural differences were highlighted), although Implicit participants were found to increase in hope at both a state and trait level.

Table 36. Examples from each sub-category relating to connection between tasks

Sub-category	Example
Helpful	"I (think) I performed better. Afterwards, I felt strangely accomplished about the whole thing"
Detrimental	"The letter test was harder than I think [SIC] and it takes a lot more focus as I have to think about two things simultaneously"

Discussion

Considering first the quantitative findings only, a decrease in negativity was seen for all participants following GRT Intervention. However, only participants in the Implicit condition were consistently more hopeful after the reflective task, with a notable improvement in THS (both Agency and Pathway sub-scales). Furthermore, GRT engagement was established as a predictor of THS improvement (again, for both sub-scales).

NT data was as expected (i.e., faster and more accurate on both Global, and Normal trials), although no differences were seen between Instructional conditions. Interestingly, baseline hope levels (specifically SHS, THS, and Pathways) was predictive of faster NT RTs; however, SHS was also predictive of a reduction in NT Accuracy. While no direct connection between GRT and NT performance was established, indirect support for this relationship may be identified via increases in hope (i.e., GRT predicted hope, and hope predicted NT performance). Bayesian evidence indicated NT data was in line with expectations, although does also imply that these predictive relationships should be treated with caution as evidence was generally only sufficient for anecdotal support.

Considered alone, qualitative data suggest the GRT was an effective intervention (i.e., in improving hope and reducing negativity). However, some differences were seen between Instructional conditions. Specifically, participants

who were naive to the intervention's purpose (i.e., Implicit condition) engaged more with the reflective task.

Both data strands converge to confirm the GRT's overall efficacy. The task was established as a generally positive activity for those in the Implicit condition. While this was also seen in the Explicit condition, the range of experiential data (i.e., the GRT was considered positive, but also detrimental) reinforces differences seen in the quantitative data (i.e., slower, less accurate NT performance). Taken as a whole, naivety to the GRT intent appears to influence its efficacy. However, the data here are not sufficiently definitive to support this conclusion fully.

Chapter Summary

Preliminary evidence was found to support the GRT's effectiveness in increasing levels of hope and decreasing negativity, and this was confirmed via convergence of both qualitative and quantitative data strands. However, no evidence was seen to suggest direct connection between GRT and NT performance, although indirect support might be suggested tentatively via Hope/GRT, or Hope/NT relationships.

Chapter 6. Exploring a Goal-Oriented Intervention and Cognitive Flexibility in the Adaptive Choice Task

Introduction

In Study 2 (*Chapter 4*) we saw confirmation of the CST failure to enhance CF performance in the ACT (Irons & Leber, 2015). That is, the CST had little to no effect on ACT performance, and this held, regardless of whether CF performance was evaluated via relatively simple measures (i.e., RT/Accuracy) or more complex ones, such as optimality. However, Study 2 's qualitative data did serve to add understanding of participants' subjective experience of the CST, when engaged in more complex aspects of a CF task. Thus, for the purposes of this thesis, the ACT (Irons & Leber, 2015) remains a more flexible paradigm, measuring a broader range of CF performance (see above).

Study 5 takes this further, by capitalizing on the flexibility of the ACT as a CF measure. By 'spanning' the range we could consider CF behaviour, this may enable the differentiation of CF to be examined more closely. Moreover, by replicating the GRT used in Study 4, we can also evaluate its efficacy in relation to more complex and/or dynamic tasks. Specifically, here I will examine 1) the GRT's effect of T2 questionnaires (i.e., SHS, THS, PANAS), 2) the extent to which the GRT impacts across the spectrum of CF behaviour, and 3) any impact instructional format has on performance (e.g., Implicit versus Explicit instructions; as established in Study 4). In Study 4, no simple CF differences (i.e., NT RT and/or Accuracy) were seen between experimental and control participants. However, by inclusion of complex performance measures such as Optimality (as well as traditional, simpler measures), we can also explore this more complex aspect of CF itself.

The Current Study: Research Questions and Predictions

The primary aim of this study is to investigate whether hope (instantiated here via operation of a goal-oriented intervention) can activate BBH-style improvement in cognition (CF performance). In addition, this study also aims to

continue to robustly evaluate the GRT. Thus, we can ask simply whether GRT participants perform better on the CF-based task (i.e., the ACT) than control counterparts. And, if performance differences emerge, do 1) they differ between CF performance types (i.e., simple versus complex)? or 2) does instruction format (Explicit or Implicit) have any impact?

Although preliminary evidence for GRT efficacy has been shown (see Study 4), it is important to evaluate hope (as the specific character strength focus of this intervention) further in relation to GRT operation. Primarily, it is predicted that goal-reflection participants will show increased levels of hope, whereas controls will not. Based on Study 4, GRT engagement measures (i.e., number of words) may also reflect a relationship between increased engagement (i.e., more words, therefore more time/effort) and increased hope. These two aspects will be combined to assess whether participants who engage more fully in the GRT also show better ACT performance. It is expected that both increased levels of hope (post intervention) and behavioural benefit to CF performance (as defined by ACT Optimality) will be seen, but with little to no differences in RT or Accuracy (i.e., more simple CF-related performance). Participant knowledge of these aims and predictions (e.g., in the Explicit Instruction Group; see e.g., Latham, Stajkovic, and Locke; 2010; Weis & Speridakos, 2011) suggests that this will not hamper increased hopefulness (or subsequent CF performance), and may, in fact, boost it.

Again, qualitative data will give some insight into subjective experience of the GRT. Further, content analysis will enable evaluation of goal-reflection practice itself, potentially indicating applied real-world value for the intervention. In other words, evaluating this intervention will not only indicate if it 'works', but also show whether it is an activity participants enjoy, and/or would continue with of their own accord.

Methods

Participants

Seventy-five participants were recruited for this study (56 female); age ranged from 18-23 years ($M = 19.47$, $SD = 1.55$). Forty-seven participants self-reported their first language as English (61.3%), four as French (5.3%), three as Chinese and Malay (4% each), two as Polish, Russian, Greek, Czech, Mandarin, and Hindi (2.7% each); the remainder reported German, Tamil, Lithuanian, Bahasa Indonesian, Romanian, Cantonese, and Hungarian (1.3% each). Participants were recruited from a panel of first year undergraduate psychology students at the University of Warwick, who each received course credit for their participation, or from University of Warwick volunteers, paid £6 for their participation.

Measures and Stimuli

Questionnaires and GRT. Following Study 4 (see *Chapter 5*), an identical questionnaire battery (i.e., SHS, THS, PANAS, free-response questionnaire), and GRT format was used.

Adaptive Choice Task. Following Study 2, an identical ACT (Irons & Leber, 2015) procedure was used. More details of the rationale for use of this paradigm are included in the overview of the methodological issues for this thesis (see *Chapter 3*).

Design

A MM design was used for this study. For the experimental aspect (i.e., GRT effect on task performance), a 3 x 3 mixed factorial design was used. The between-participants factor was Instructional Condition (Implicit, Explicit, and Control), with a within-participants factor of Block (One, Two, Three). The dependant variables were Reaction Time (RT, ms), Accuracy (error rates, %), and Optimality (%). For the observational element (i.e., relationships between specific GRT behaviour etc.), engagement was measured by the number of words

written. All questionnaires were recorded twice; before completing the GRT (T1), and after finishing the CF task (T2). For the qualitative component of the study, the free-response questionnaire was administered to all participants. These data were collected to address two specific questions; 1) *what connection, if any, do participants discern between the GRT and the ACT?* And 2) *how do participants experience the GRT and reflection on goal achievement?*

In addition, as in the original ACT study (see Irons and Leber, 2013) and Study 2, participants were asked three additional questions directly after ACT completion, in order to probe participants' strategy for selecting targets. The questions were; 1) *"During the cognitive task, how did you decide which target to search for? Were there any particular factors that made you want to respond to one instead of the other?"*, 2) *"Did you switch between the two targets? If so, what made you decide to switch?"*, and 3) *"On some trials, there were more blue items in the display, and other times there were more red items. Did you get the impression that this change occurred abruptly, or gradually?"*. Participants were encouraged to provide as much detail/feedback as they chose, without an explicit time limitation.

Procedure

Participants were randomly allocated to one of the Instructional Conditions (Implicit, Explicit, or Control) and were given an information sheet, before fully informed consent was sought. Testing took place in individual sound-attenuated laboratory cubicles. To begin, all participants completed the SHS, THS, and PANAS (T1). Detailed instructions (see Stimuli & Measures section above) were then provided for either the GRT (i.e., Implicit, Explicit), or Typical Day (i.e., Control) task.

GRT Procedure. In the Implicit instructional condition, participants were given an instruction sheet for the GRT, where they were asked to reflect on a goal they had previously achieved. No parameters for the goal were indicated, only that it should be meaningful to the participant *and* had been achieved.

Completion of the GRT was self-paced, and undertaken alone, with instructions to inform the researcher when finished. The Explicit instructional condition was identical to the Implicit condition, with one additional step. Before starting the GRT, participants were informed (by the researcher using a script) why they were being asked to complete the GRT, and what the expected outcomes were (e.g., increased hope, better performance on the subsequent ACT task). In the Control condition, participants were given instructions for the Typical Day task, where they were asked to describe what they would consider to be a typical day. Similarly, once instructed, task performance was self-paced in isolation, with instructions to inform the researcher when finished.

ACT Procedure. An identical procedure to Study 2 (pg. 105) for the ACT was used. Following completion of the reflective task, participants were given instruction for the ACT. They were informed verbally to read the instructions carefully, and to signal any questions before starting the task. Instructions were presented on screen. For each trial, two targets appeared, one red square with a number between 2 and 5, and one blue square with a number between 2 and 5 (see Figure 31). All other squares were red, green, or blue and contain a number greater than 5. There was always a red *and* blue target for detection, but it was participants' choice which one they selected. To indicate a found target, participants were asked to press the key 'V' for 2, 'B' for 3, 'N' for 4, and 'M' for 5. Finally, participants were instructed that the targets for each trial would not be the same number (i.e., if the red target was 2, then the blue had to be 3, 4, or 5), and that they should respond as quickly but as accurately as possible.

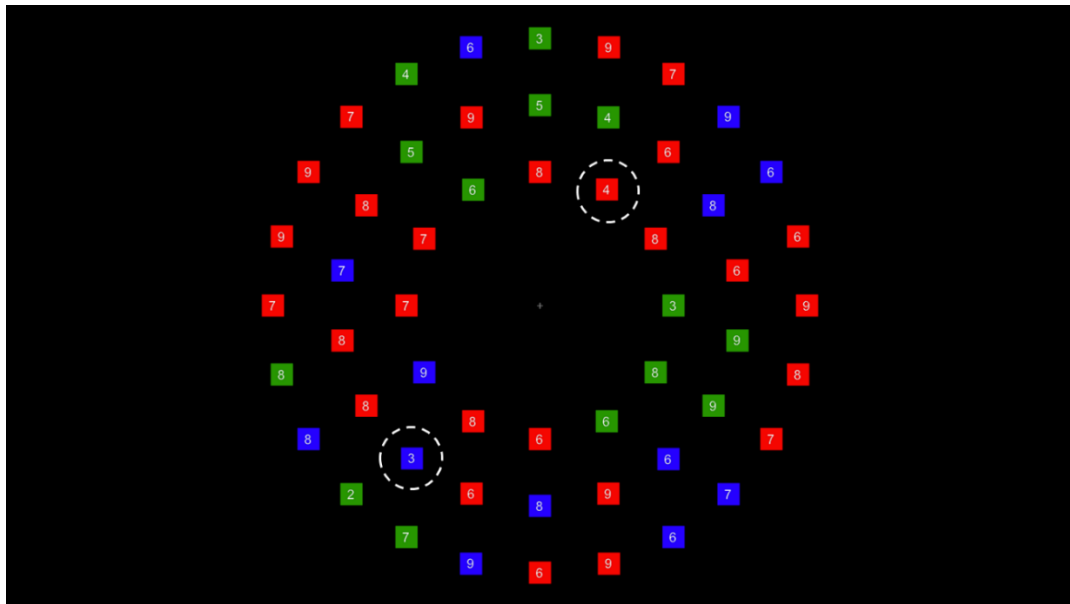


Figure 31. Typical ACT trial. Two correct target trials are outlined, participant would press 'B' for the blue target, and 'N' for the red target.

Upon completion of the ACT, participants were given the SHS, THS, and PANAS again (T2), plus the free-response questionnaire. Here, they were asked to reflect on the study as a whole, and describe any thoughts or feelings that occurred to them at any point. In particular, participants were asked to comment on their experience of the GRT, and any resulting thoughts and/or feelings that arose.

Following data collection, Frequentist analyses were conducted using SPSS (IMB Corporation, 2016). Bayesian statistical analyses were also conducted, using the free software JASP (version 0.9.0.1) and default priors (JASP Team, 2017; see *Chapter 3: Bayesian Analysis*). Free-response data were collated using NVivo (QSR International Pty Ltd, 2012), and analysed using a content analysis methodology (Hsieh & Shannon, 2005; Mayring, 2000).

Results

In order to simplify the structure of the following findings, this section has been divided into two subsections: quantitative and qualitative data. Firstly,

descriptive statistics are outlined, followed by the questionnaires and experimental data (i.e., descriptive statistics for the ACT, and subsequent inferential analyses). Note, Bayesian analysis is reported with ACT data, to ensure a full and robust statistical approach to the data²⁷. Second, qualitative data are explored using Content Analysis (Hsieh & Shannon, 2005), with textual presentation of the findings.

Reflective Tasks

Descriptive Statistics. Table 37 below displays mean number of words written by participants, grand mean, and then item by item²⁸. Participants in the Implicit condition wrote the most words ($m = 77.55$, $SD = 47.27$), while the Control condition wrote the fewest ($m = 52.52$, $SD = 35.80$). Dispersion was substantial (collapsed mean, across all conditions; $m = 63.84$, $SD = 42.91$), and similar across all groups.

Table 37. Mean number of words written by participants by Condition

	Implicit		Explicit		Control	
	Mean	SD	Mean	SD	Mean	SD
Grand mean	77.55	47.27	61.46	45.65	52.52	35.80
Q1	24.12	49.56	15.88	14.97	103.96	76.97
Q2	78.96	60.48	56.24	44.92	13.32	20.52
Q3	119.04	56.47	103.48	106.67	-	-
Q4	88.08	58.15	70.24	61.61	40.28	31.17

Frequentist Analysis. No differences with anecdotal evidence for the null were seen in the average words written between Instructional Conditions as determined by a one-way ANOVA, $F(2, 74) = 2.16$, $p = 1.23$, $BF_{inc} = 0.59$.

²⁷ Both in terms of experimental power and avoidance of Type 1 error, due to the number of analyses required by a complex design. Analysis of Effects are reported as BF_{inc} , and BF_{10} for correlational analyses.

²⁸ Descriptive data for all questions reported in Table 38, although only the 'overall' figure will be used from this point forwards as a measure of GRT engagement.

Questionnaire data

Descriptive Statistics. Participants completed each questionnaire at two time points, once before (T1) and once after (T2) the GRT and ACT; the data are displayed in Table 38 below. Participants in the Implicit condition showed an increase between T1 and T2 (i.e., increase in SHS and THS, for both subscales, and a decrease in PN); however, a decrease was also found in positivity (i.e., PP). The Control condition shows a similar pattern of results, although less pronounced (e.g., THS differences Control: $m = 0.28$ compared to Implicit: $m = 0.96$). Finally, the Explicit condition saw an increase between T1 and T2 for SHS and THS (and subscales), a decrease for negativity, and was the only condition to have a substantial increase in positivity (PP difference; $m = 2.48$, $SD = 4.77$).

Table 38. Response for SHS, THS (Agency/Pathway subscales) and PANAS
(Positive/Negative subscales), by both Time Points and Condition

Questionnaire		Condition					
		Implicit		Control		Explicit	
		Mean	SD	Mean	SD	Mean	SD
T1	SHS	33.04	7.92	34.2	6.27	33.64	5.17
	PANAS Positive	33.72	6.87	32.12	6.11	31.6	7.10
	PANAS Negative	15.88	5.55	16.4	5.84	17.28	7.04
	THS	44.72	9.29	46.64	5.87	45.52	8.07
	THS Agency	21.88	4.68	23.24	3.15	22.76	4.44
	THS Pathway	22.84	5.14	23.4	3.78	22.76	4.40
T2	SHS	34	8.43	34.28	6.18	35.04	5.81
	PANAS Positive	32	8.67	31.64	6.56	34.08	8.05
	PANAS Negative	13.56	3.28	14.92	5.54	14.76	6.48
	THS	45.68	10.16	46.92	6.41	47.4	8.17
	THS Agency	22.36	4.96	23.24	3.22	23.6	4.60
	THS Pathway	23.32	5.72	23.68	4.07	23.8	4.12
Differences	SHS	0.96	3.06	0.08	2.41	1.4	3.40
	PANAS Positive	-1.72	6.55	-0.48	2.92	2.48	4.77
	PANAS Negative	-2.32	3.65	-1.48	2.92	-2.52	3.06
	THS	0.96	4.08	0.28	2.59	1.88	3.41
	THS Agency	0.48	2.04	0	1.29	0.84	1.91
	THS Pathway	0.48	3.06	0.28	1.82	1.04	2.35

*N = 25 per Condition

Frequentist Analysis

Difference between questionnaire score at T1 and T2. A mixed 2 x 3 ANOVA was conducted on the questionnaires (Figure 32), with within-participants factor of Time (T1, T2), and between-participants factor of

Instructional Condition (Implicit, Explicit, and Control); the results are displayed in Table 39 below.

Main effects of Time were seen for SHS, $F(1,72) = 5.56, p = .02, \eta^2 = .07$, $BF_{inc} = 2.01$; PN, $F(1,72) = 32.04, p < .001, \eta^2 = .31, BF_{inc} = 47337.52$; THS, $F(1,72) = 6.96, p = .01, \eta^2 = .09, BF_{inc} = 3.81$; Agency, $F(1,72) = 4.59, p = .04, \eta^2 = .06, BF_{inc} = 1.34$, and Pathway, $F(1,72) = 4.46, p = .04, \eta^2 = .06, BF_{inc} = 1.29$. Responses at T2 were more 'positive' than T1 (i.e., increased hope, decreased negativity). Notably, only differences in PN and THS were associated with extreme and moderate evidence in support, respectively. An interaction with moderate evidence was found between PP and Condition, $F(2,72) = 4.71, p = .01, \eta^2 = .12, BF_{inc} = 4.19$; the Explicit condition increased in PP between T1 and T2. No other effects or interactions achieved significance (all $F_s < 1.41$, all $p_s > .25$).

Table 39. Mixed ANOVA results for Time (i.e., differences in questionnaire results from T1 to T2), by Condition

Questionnaire	Effect	F	df	p	η^2	BF _{inc}
SHS	Time	5.56	1,72	.02**	.07	2.01
	Condition	0.12	2,72	.89	.00	0.43
	Time * Condition	1.27	2,72	.29	.03	0.30
THS	Time	6.96	1,72	.01**	.09	3.81
	Condition	0.28	2,72	.76	.00	0.50
	Time * Condition	1.38	2,72	.26	.04	0.28
Agency	Time	4.59	1,72	.04**	.06	1.34
	Condition	0.58	2,72	.56	.02	0.54
	Time * Condition	1.41	2,72	.25	.04	0.33
Pathway	Time	4.46	1,72	.04**	.06	1.29
	Condition	0.07	2,72	.93	.00	0.36
	Time * Condition	0.64	2,72	.53	.02	0.18
PP	Time	0.03	1,72	.87	.00	0.20
	Condition	0.17	2,72	.85	.01	0.26
	Time * Condition	4.71	2,72	.01**	.12	4.19
PN	Time	32.04	1,72	<.001**	.31	47337.52
	Condition	0.37	2,72	.69	.01	0.39
	Time * Condition	0.73	2,72	.48	.02	0.20

** = Significant effect <.005

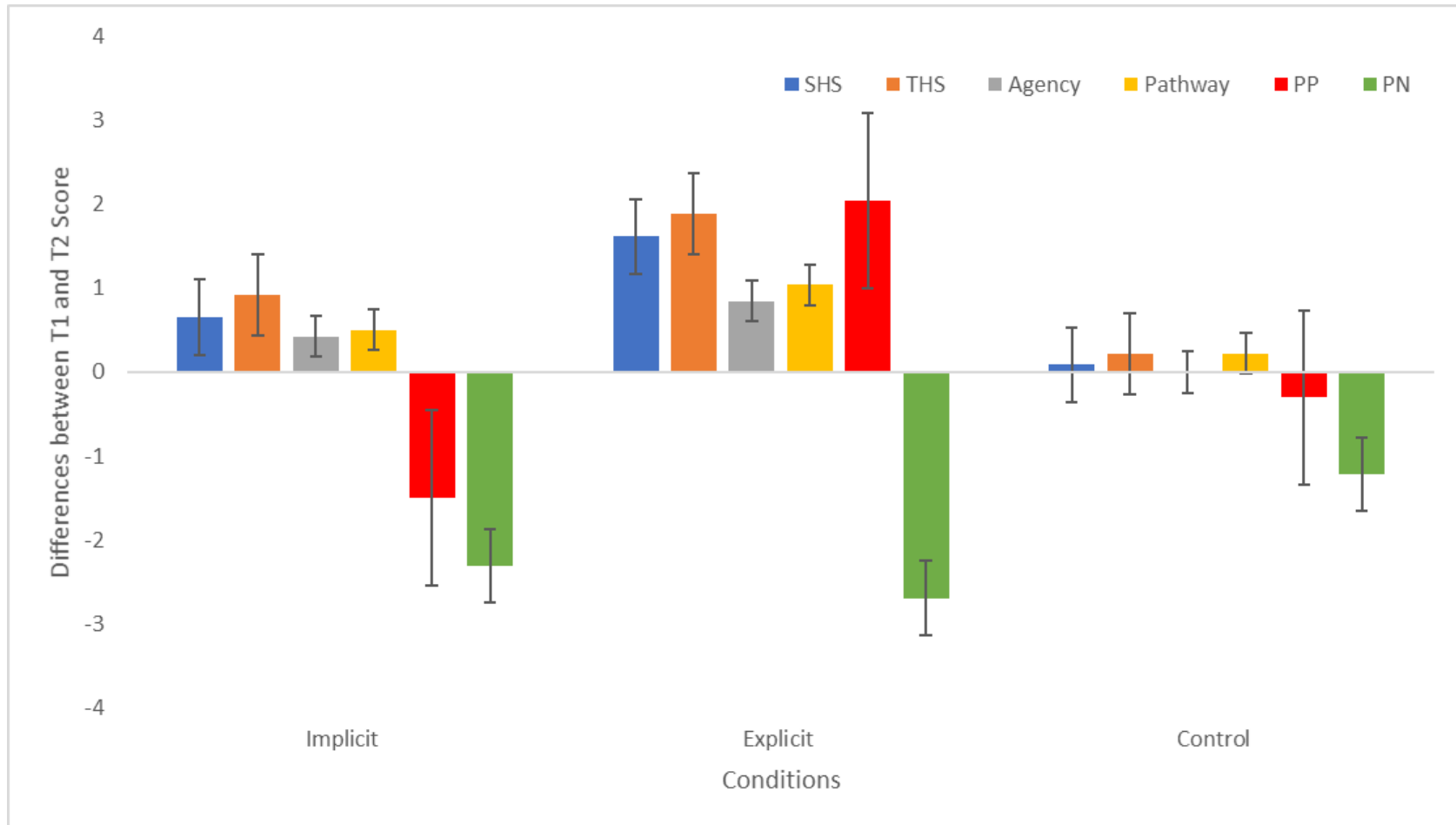


Figure 32. Graph depicting differences in Questionnaires scores between T1 and T2 by Condition. Error bars indicate ± 1 standard error of the mean.

GRT relationship with Questionnaires Variables. A Pearson's Product Moment correlation was conducted to establish associations between questionnaire scores (at both T1 and T2) and GRT engagement (see Table 40).

Table 40. Correlational analyses between GRT engagement and questionnaires at T1 and T2

Time		Questionnaires					
		SHS	PP	PN	THS	Agency	Pathway
T1	<i>r</i>	.23*	.25*	.02	.15	.23*	.05
	<i>p</i>	.05	.03	.88	.19	.04	.66
T2	<i>r</i>	.19	.18	-.11	.18	.25*	.09
	<i>p</i>	.11	.12	.37	.13	.03	.43

* = Significant < .05

Simple linear regression analyses were used to provide further details of the relationships (Table 41). Baseline (T1) SHS, PP, and Agency scores were predictive of GRT engagement; in addition, GRT engagement predicted T2 Agency scores (Figure 33). However, in all cases only anecdotal evidence for the alternative hypothesis was obtained, and therefore these relationships, should be considered with caution.

Table 41. Regression analyses summary for T1 questionnaire scores predicting GRT engagement, and GRT engagement predicting T2 questionnaire score

Questionnaire	<i>t</i>	<i>p</i>	<i>R</i> ²	<i>B</i> ⁰	<i>B</i> ¹	<i>BF</i> ₁₀
T1 SHS	2.04	.05	.05	10.03	1.57	1.42
T1 Agency	2.05	.04	.05	7.66	2.48	1.45
T1 PP	2.23	.03	.06	10.00	1.66	1.98
T2 Agency	2.17	.03	.06	21.52	0.02	1.79

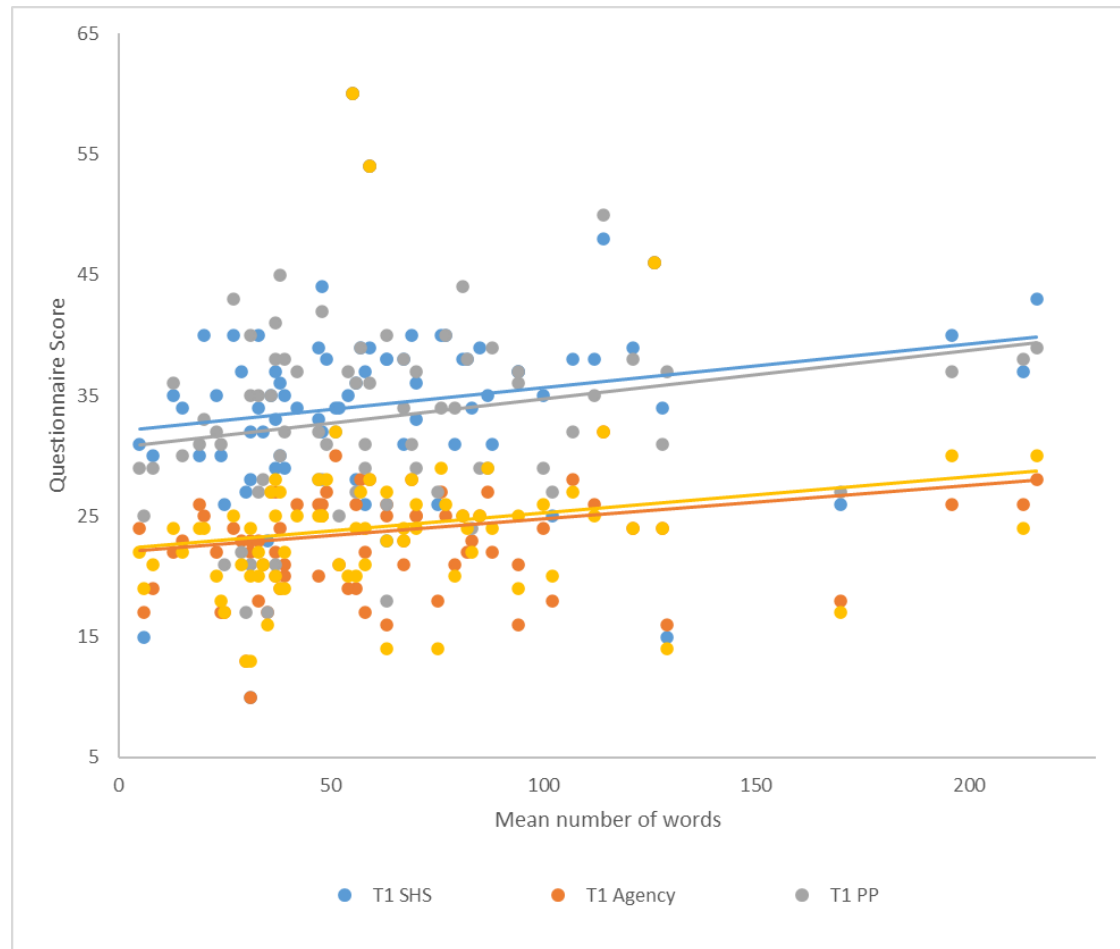


Figure 33. Scatterplot depicting relationship between THS, Pathway, and Agency scores at T2, and mean number of words produced for the GRT.

ACT Data

Descriptive Statistics. Outliers were removed from the data automatically (as per Irons and Leber, 2013). For RT, screening was on the conservative ranges of < 300ms to more than 3 standard deviations about the individual's RT mean, and for mean Error Rate > 15%. Descriptive statistics for ACT performance are displayed in Table 42, paired with short summaries of each variable. As a whole, these descriptive data suggest ACT performance was comparable across all measures, regardless of Instructional condition.

Reaction Time. Collapsed across all blocks, RTs were faster for the Explicit condition ($m = 2943.89\text{ms}$, $SD = 623.78$), followed by Implicit and Control conditions ($m = 3056.22\text{ms}$, $SD = 711.87$; $m = 3070.62\text{ms}$, $SD = 628.38$ respectively). With a mean RT range was only 126.73ms, GRT conditions were faster, but only by a negligible margin.

Accuracy. For all conditions, error rates were similar, with a minimal range (0.52%) between the most accurate (Implicit; $M = 98.49\%$, $SD = 1.07$) to the least (Explicit; $M = 97.97\%$, $SD = 1.54$). Interestingly, both GRT conditions (Implicit and Explicit) improved slightly between Blocks 1 and 3 (Implicit difference = 0.95%; Explicit difference = 1.67%), however the Control condition decreased slightly in accuracy between Blocks 1 and 3 (difference = -0.14%).

Optimality. Again, similar Optimality scores were seen across conditions; a small range (0.76%) between the most optimal condition (Implicit; $m = 62.04\%$, $SD = 15.14$) and least optimal condition (Control; $m = 61.28\%$, $SD = 14.21$). While GRT conditions were more optimal overall, all conditions increased in optimality between Block 1 and 3 ($m = 5.35\%$, collapse across conditions).

Table 42. ACT RT (ms), Accuracy (%), and Optimality (%), by Block and Condition

Instructional Condition	Block	Dependant Variable					
		RT		Error Rate		Optimality	
		Mean (ms)	SD	Mean (%)	SD	Mean (%)	SD
Implicit	1	3372.54	917.52	97.81	2.22	57.57	14.23
	2	2993.59	817.43	98.90	1.24	63.07	19.46
	3	2814.43	557.12	98.76	1.06	65.41	17.97
	Grand Mean	3056.22	711.87	98.49	1.07	62.04	15.14
Explicit	1	3128.96	752.28	97.14	2.36	60.78	13.79
	2	2900.22	629.29	97.95	2.02	61.08	18.31
	3	2808.62	572.56	98.81	1.50	63.33	17.61
	Grand Mean	2943.89	623.78	97.97	1.54	61.73	15.10
Control	1	3352.33	817.59	97.90	1.62	57.80	12.92
	2	3035.46	697.02	98.95	1.43	62.52	16.99
	3	2836.17	471.94	97.76	2.76	63.45	16.87
	Grand Mean	3070.62	628.38	98.21	1.48	61.28	14.21

RT

Frequentist Analysis. A mixed 3 x 3 ANOVA was conducted on ACT RTs (Figure 34), with a within-participants factor of Block (1, 2, 3), and between-participants factor of Instructional Condition (Implicit, Explicit, and Control). A main effect for Block was found as Block 3 had the fastest RT and Block 1 the slowest²⁹, $F(1.65, 118.79) = 41.85$, $p < .001$, $\eta^2 = .37$, $BF_{inc} = 9.91$. Pairwise comparison by Block revealed that all Blocks were significantly different from each other (all $ps < .001$). No effect was found for Condition with anecdotal evidence for the null, $F(2, 72) = 0.29$, $p = .75$, $BF_{inc} = 0.26$, nor an interaction between Condition and Block with anecdotal evidence for the null, $F(4, 144) = 1.04$, $p = .39$, $BF_{inc} = 0.14$.

²⁹ Mauchly's test of sphericity indicated that the assumption of sphericity was violated, $\chi^2(2) = 16.94$, $p < .001$, therefore the Greenhouse-Geisser correction has been used

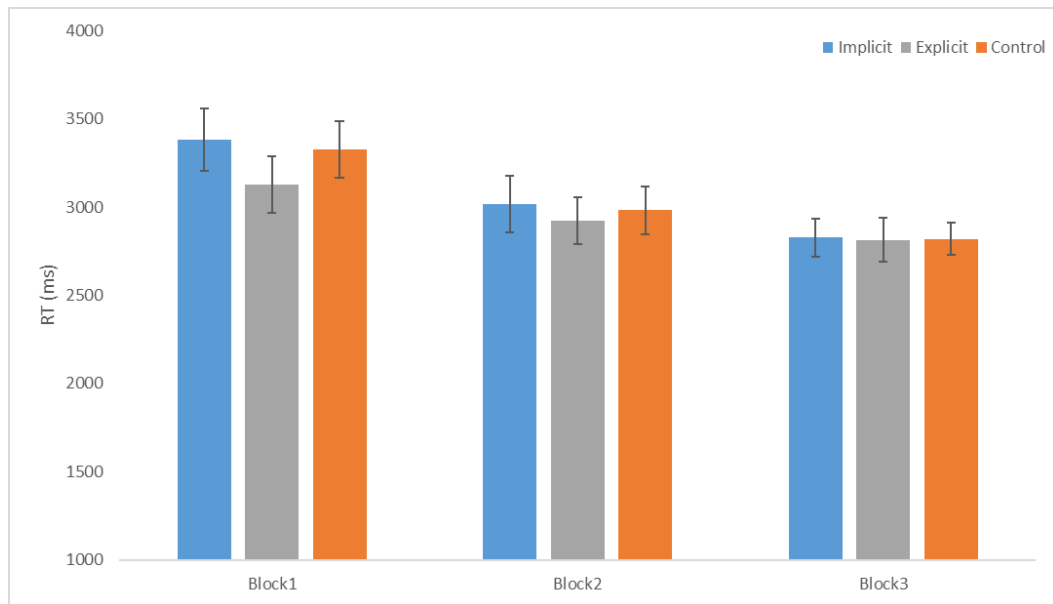


Figure 34. Graph depicting Accuracy across Block, by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of GRT. A Pearson's Product Moment correlation was conducted to assess any relationship between RT and the GRT engagement. A negative, moderate relationship was found, $r(75) = -.26$, $p = .02$. Subsequently, a simple linear regression found GRT engagement predicted RT ($t = 2.30$, $p = .02$, $R^2 = 0.07$, $BF_{10} = 2.25$), and RT was equal to $3269.00 + (-3.84 \times \text{word average})$; see Figure 35. Note, Bayesian evidence for this relationship was anecdotal.

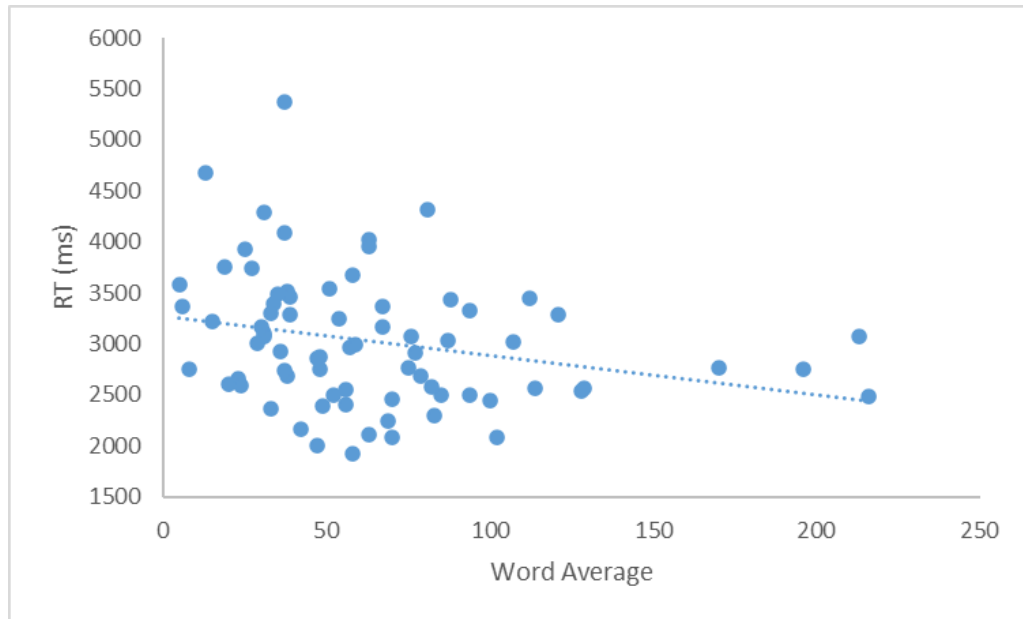


Figure 35. Scatterplot depicting relationship between average words produced for the GRT and RT.

Predictiveness of Questionnaires. A series of Pearson's Product Moment correlations were conducted to assess relationships between RT and hope questionnaires at both T1 and T2; no relationships were found (all $r_s < .11$, all $p_s > .33$, $BF_{10} < 0.01 - 0.01$). Therefore, no subsequent regression analyses were calculated. Bayesian evidence ranged from very strong to extreme in support of the null hypothesis, indicating that there was no predictive relationship between hope and RT.

Accuracy

Frequentist Analysis. An identical mixed 3 x 3 ANOVA was conducted on ACT accuracy data (Figure 36). A within-participants factor of Block (1, 2, 3), and between-participants factor of Condition (Implicit, Explicit, and Control). A main effect with very strong evidence for Block was found, $F(1.76, 127.03) = 8.62$, $p = .001$, $\eta^2 = .11$, $BF_{inc} = 90.55$, with Block 2 showing highest Accuracy and Block 1

the lowest³⁰. Pairwise comparison by Block revealed that Block 1 ($m = 97.62\%$, $SD = 2.09$) was less accurate than both Blocks 2 ($m = 98.60\%$, $SD = 1.64$, $p = <.001$) and 3 ($m = 98.44\%$, $SD = 1.95$, $p = .005$), although Blocks 2 and 3 did not differ ($p = .441$). Further, a Condition x Block interaction was shown, $F(4,144) = 3.26$, $p = .01$, $\eta^2 = .08$, $BF_{inc} = 1.31$, although this evidence was only anecdotal, suggesting caution in interpretation. Finally, no difference was found between the Conditions, with anecdotal evidence for the null, $F(2,72) = 0.90$, $p = .410$, $BF_{inc} = 0.20$.

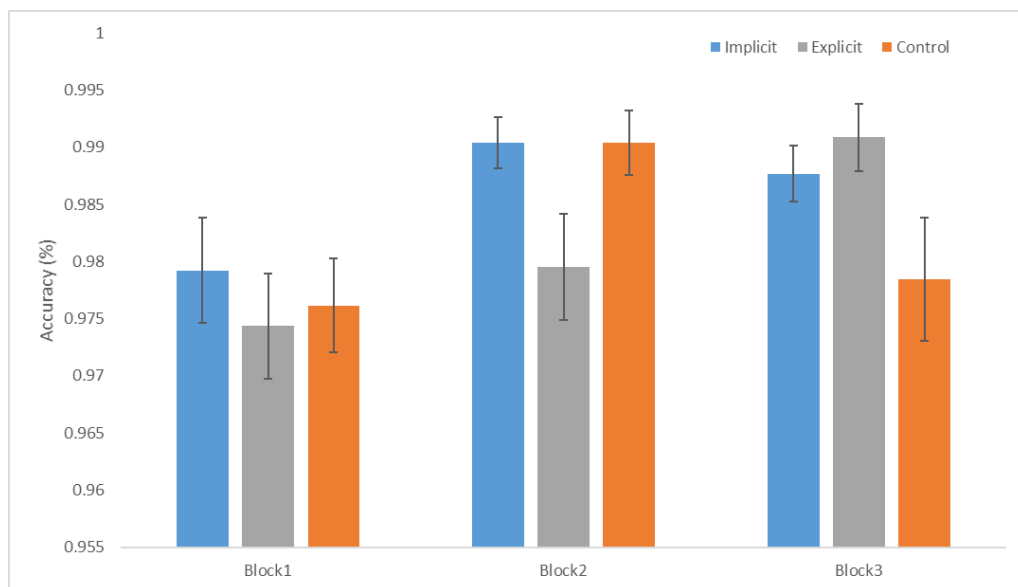


Figure 36. Graph depicting Accuracy across Block, by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of GRT. A Product Moment correlation was conducted to assess any relationship between Accuracy and GRT engagement. No reliable relationship was found ($r = .23$, $p = .06$), therefore no regression analysis was calculated. Notably, a Bayesian analysis suggested anecdotal evidence in favour of a positive correlation ($BF_{inc} = 1.38$).

Predictiveness of Questionnaires. A series of Pearson's Product Moment correlations were conducted to assess any relationship between Accuracy and

³⁰ Mauchly's test of sphericity indicated that the assumption of sphericity was violated, $\chi^2(2) = 10.18$, $p = .006$, therefore the Greenhouse-Geisser correction has been used

hope questionnaires at both T1 and T2. No relationships were found (all r s < .23, all p s > .05), therefore no regression analysis were calculated. Subsequent Bayesian analysis yielded anecdotal evidence for the null across all questionnaires, BF_{10} 0.28 – 0.83).

Optimality

Frequentist Analysis. An identical mixed 3 x 3 ANOVA was conducted on ACT Optimality (%; Figure 37), with within-participants factor of Block (1,2,3) and between-participants factor of Condition (Implicit, Explicit, Control). A main effect with strong evidence was found for Block, $F(1.80, 129.72) = 6.57$, $p = .002$, $\eta^2 = .08$, $BF_{inc} = 13.07$; Block 3 was most optimal while Block 1 was least³¹. Pairwise comparisons by Block revealed that in Block 1 ($m = 58.72\%$, $SD = 13.55$) participants were less Optimal than Block 2 ($m = 62.22\%$, $SD = 18.05$, $p = .02$), and Block 3 ($m = 64.06\%$, $SD = 17.28$, $p = .002$), although Blocks 2 and 3 did not differ ($p = .15$). There was no effect of Condition, with anecdotal evidence in support of the null, $F(2, 72) = 0.02$, $p = .98$, $BF_{inc} = 0.16$. Nor was there any Condition x Block interaction, $F(4, 144) = 0.77$, $p = .55$, $BF_{inc} = 0.06$, with strong evidence in support of the null.

³¹ Mauchly's test of sphericity indicated that the assumption of sphericity was violated, $\chi^2(2) = 8.28$, $p = .016$, therefore the Greenhouse-Geisser correction is used

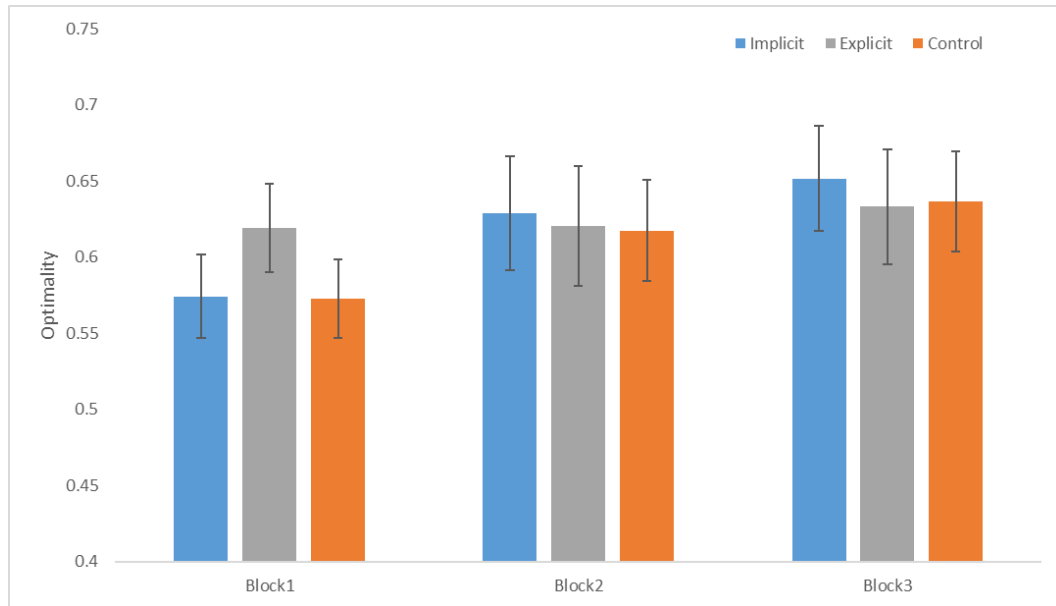


Figure 37. Graph depicting Optimality across Block, by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of GRT. A Pearson’s Product Moment correlation between Optimality and GRT engagement found no significant relationship ($r = .21$, $p = .08$, $BF_{10} = 0.95$), therefore no regression analysis was calculated. Bayesian analysis indicated anecdotal evidence in support of the null hypothesis.

Predictiveness of Questionnaires. A series of Product Moment correlations were conducted to assess any relationship between Optimality and hope questionnaires at both T1 and T2; this resulted in a high number of correlations (see Table 43 below). The only relationship not achieving statistical significance was T1 Pathway and Optimality ($p = .07$).

For each significant correlation, a simple linear regression³² was conducted to provide further details of the relationship (see Table 44 below). Baseline hope (T1) score for SHS, Agency, and THS were predictors of Optimality (all $ps < .04$); see Figure 38. Additionally, ACT Optimality was a predictor of all hope

³² A multiple regression could not be used as the questionnaires were too highly correlated, violating statistical assumptions.

questionnaire scores at T2 (all $ps < .04$); see Figure 39. However, it is of note that in all cases above, the variance accounted for was low (all $R^2 = < 0.11$), and none reached a high level of significance (i.e., all $ps = > .001$). Overall, this suggests hope and Optimality may have a predictive relationship, but caution should be taken in interpreting these findings. Only T1 and T2 SHS was found to have strong and moderate evidence ($BF_{10} = 10.26$, $BF_{10} = 3.71$ respectively) suggesting state hope predicts Optimality.

Table 43. Correlational analyses between hope questionnaires (SHS, THS, plus Agency and Pathway sub-scales) at T1 and T2, and Optimality

Time		Questionnaires			
		SHS	Agency	Pathway	THS
T1	<i>r</i>	.34*	.23*	.21	.25*
	<i>p</i>	.003	.04	.07	.03
T2	<i>r</i>	.30*	.24*	.25*	.27*
	<i>p</i>	.01	.04	.03	.02

* = significant $< .05$

Table 44. Regression analyses summary for T1 and T2 questionnaire scores predicting Optimality

Time	Questionnaire	<i>t</i>	<i>p</i>	<i>R</i> ²	<i>B</i> ⁰	<i>B</i> ¹	<i>BF</i> ₁₀
T1	SHS	3.05	.003	.11	.36	.01	10.27
	THS	2.16	.03	.07	.40	.01	1.28
	Agency	2.06	.04	.06	.43	.01	1.04
T2	SHS	2.65	.01	.09	25.91	13.84	3.71
	THS	2.35	.02	.07	37.38	15.05	1.89
	Agency	2.15	.04	.06	18.65	7.17	1.25
	Pathway	2.19	.03	.06	18.74	7.88	1.38

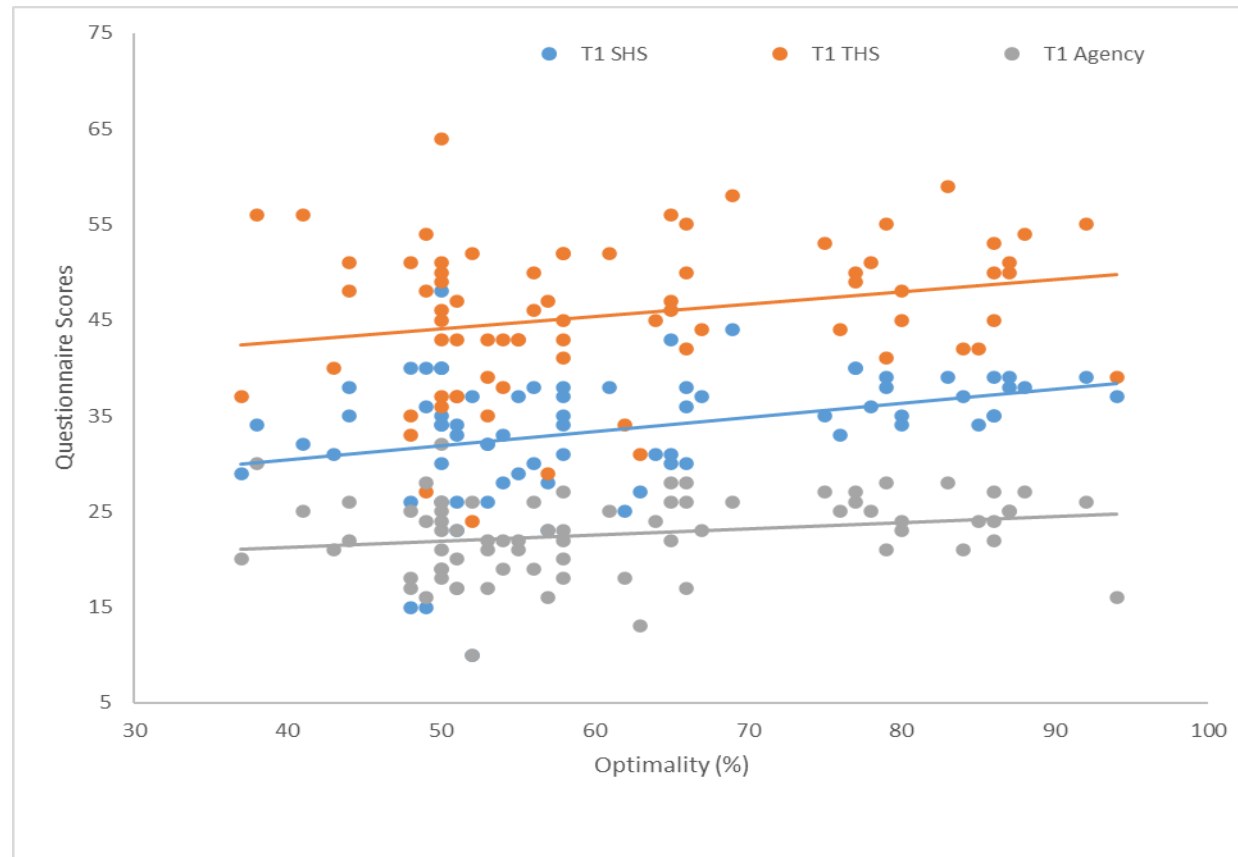


Figure 38. Scatterplot depicting relationship between SHS, THS, and Agency scores at T1, and Optimality.

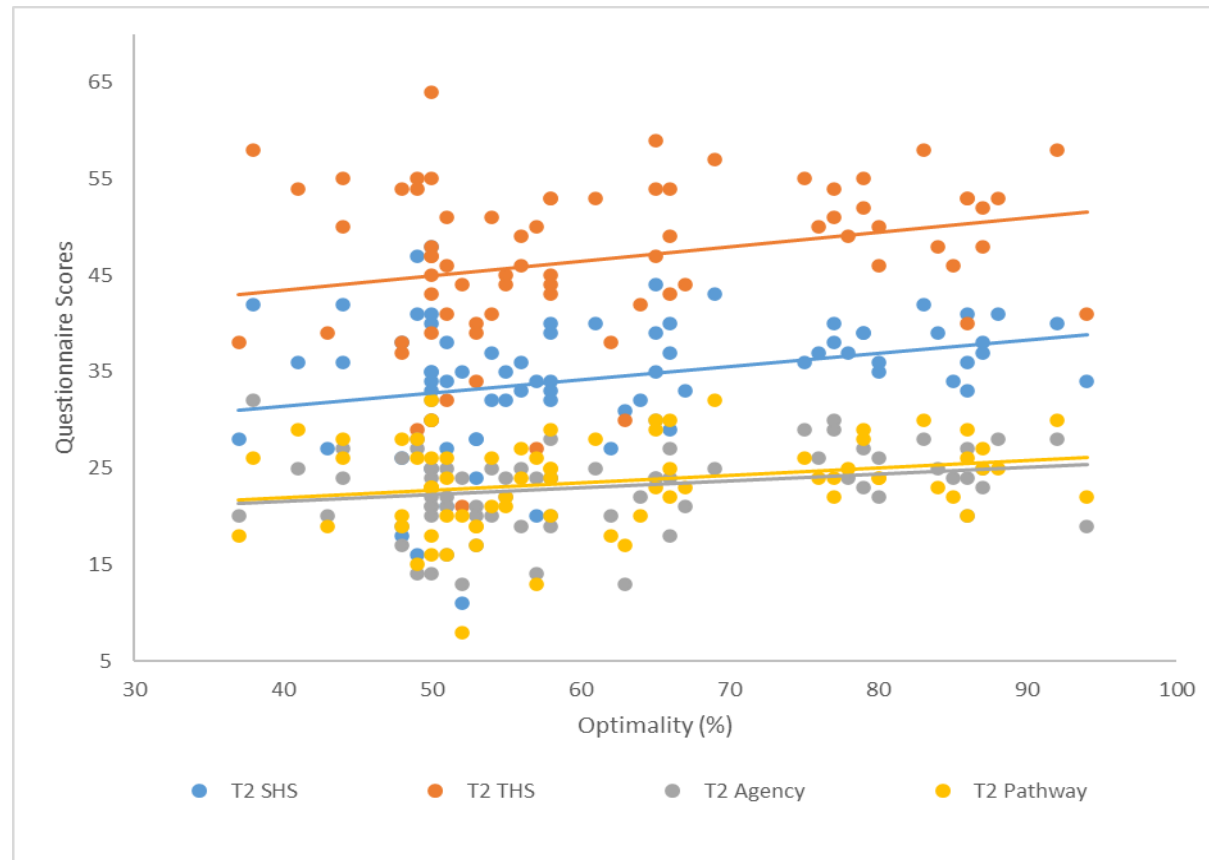


Figure 39. Scatterplot depicting relationship between SHS, THS, and Agency scores at T2, and Optimality.

Qualitative Data

ACT Strategies. Qualitative data was collected as in Irons and Leber (2016), to explore participants' selection strategies during the ACT. Given the brief, highly focused nature of responses, a content analysis procedure (e.g., Hseish & Shannon, 2005) was used to convert data into frequency categories. Responses to the three questions (see *Study 5: Materials* section) are shown below. Notably, participants were able to respond freely, therefore not all responses were coded (or codable), and some participants provided multiple answers to each question. In this latter case, responses were coded to their most representative category.

Target Selection Strategy. When asked about their target selection strategy, five categories were identified across the three instructional conditions (displayed in Table 45 below). The majority of participants (45%) suggested they tried to optimise their behaviour, and search for targets with fewer options; here the Implicit group was represented slightly more. In contrast, slightly fewer than half (34%) the statements suggested arbitrary selection of a colour.

Table 45. Responses and frequency data for each of the Sub-Categories Relating to Target Selection, separated by Condition

Sub-Category	Implicit	Control	Explicit	Examples
Blue Focus	1	10	8	"I decided to only search for the blue colours"
Red Focus	2	0	3	"I mainly choose red first"
No Focus	4	4	3	"Didn't use any particular method"
First to Find	3	2	3	"I just looked for the first one I could see"
Proportion	14	10	10	"I was looking for the coloured target that had fewer squares overall"

Target Switching. Exploring target switching (i.e., from red to blue, and visa versa), a larger proportion of participants (46%) adhered to expected optimisation behaviour (i.e., switching when one colour was proportionally

larger). However, some participants were not optimised, searching exhaustively, switching randomly, or not switching at all. Table 46 below displays some examples of these categories, and their distribution between the instructional conditions.

Table 46. Number of Responses by Sub-Category relating to Target Switching, by Condition

Sub-Category	Implicit	Control	Explicit	Examples
Proportion of Colour	16	10	9	"the proportion and distribution of the targets made me switch so as to find the one that stands out more"
No Specific Reason	1	1	2	"I just randomly switched"
Exhaustive Switch	4	2	3	"If I couldn't find the target of one colour easily then I would switch to looking for the other colour target"
Location	3	2	5	"just based on which caught my eye first"
No Switch	1	11	6	"No"

Distractor Changes. In response to questions about participants' awareness of distractor target colour in each trial (i.e., if participants noticed changes, and how abruptly changes occurred), the majority of participants (48%) suggested that the changes were abrupt. A further 32% suggested the switch was more gradual. Table 47 below displays examples of these categories, and their distribution between the conditions.

Table 47. Number of Responses by Sub-Category relating to Distractor Changes, by Condition

Sub-Category	Implicit	Control	Explicit	Examples
Abrupt	11	11	15	"Abruptly"
Gradual	9	10	6	"Gradually"
Unaware	5	5	2	"I felt like the change happened both abruptly and gradually"

Free-Response Questionnaire. Participants' responses to the free response questionnaires were analysed using a Content Analysis methodology similar to Study 4. A 'top-down' approach was adopted to address two specific questions; 1) how do participants feel about the GRT task? And 2) what (if any) impact do they think it may have on performance?

Importantly, qualitative analysis procedures recommend acknowledgement of implicit bias arising from prior analyses. Thus, while content analysis here was conducted following standardised procedures, findings from Study 4 use of the GRT will have influenced (or are highly likely to have influenced) this analysis. On a pragmatic level, categories identified in previous analyses do not constrain this analysis (i.e., new, previously undefined categories have been used), but where similarities have occurred, this has been noted (e.g., via identical category names).

Reflecting on a Goal. The most populated category identified the GRT to be a positive activity, which was made up of two sub-categories: 'Motivational' and 'Effective Reflection'. Motivational codes revealed participants to be inspired or focused to work towards current goals. Similarly, participants found the GRT to be effective at enabling a positive reflection on an accomplished goal.

While far less common, a negative category was also identified, in which participants generally suggested the GRT caused a sense of concern or worry about progress towards current goals. In addition, a small but notable set of

neutral codes suggested neither positive or negative experience, but instead highlighted practical issues of selecting a goal previously accomplished.

Table 48. Examples of each of the Sub-Categories relating to the reflective tasks

	Sub-category	Example
Positive	Motivational	"It made me feel more focused so that I can work towards achieving my goals now"
	Effective	"It felt good to think back to a goal that I achieved
	Reflection	and was proud of brought back sweet memories!"
	Control condition	"It made me feel proud to realise I do not waste my days"
Neutral	Difficult task	"it was hard to find a goal that was worthy enough to think about"
	Control Condition	"It felt normal to describe the experience because my days are very similar every week"
Negative	Concern	"It made me realise how far off I am from where I should have been and how I should try harder for the goals I have now"
	Control condition	"Uninspired"

Both GRT Instructional conditions (Implicit and Explicit) were represented in positive and neutral categories. However, the Explicit condition made up the majority of the negative category, even though it was a proportional smaller category overall. Finally, it is also notable that the Control condition also comprised responses that could have been coded into all three categories.

Impact of GRT. In considering what, if any, impact of the GRT participants perceived, two categories emerged: 1) General behaviour (i.e., beyond the scope of the study), 2) ACT task performance. Regarding general behaviour, two sub-categories were identified (see Table 49 below). The majority of participants, evenly represented across conditions, suggested a general behavioural benefit to goal attainment. Overwhelmingly, the GRT was indicated to be *Impactful*, and

goal reflection suggested to have a positive effect (total 46 codes, equally divided across GRT conditions). Conversely, the *No Impact* category, while much smaller (only three codes), was mostly made up of items from Explicit condition participants (two out of three).

Table 49. Example of each sub-category relating to the impact of the GRT generally

Sub-category	Example
Impactful	“Yes, probably. I think it's a reminder that hard things are doable and a slight boost of self-confidence”
No Impact	“I think focusing on goals I’ve already achieved distracts me from moving forwards”

For ACT Task Performance category, two sub-categories were also identified (Table 50). The GRT was considered to be mostly helpful (i.e., it was an enjoyable task, or something that made participants feel better), again divided equally between GRT conditions. Interestingly, and in contrast to expectations, no evidence was found for a detrimental connection between tasks, although a small sub-category (six items) suggested no connection (i.e., the GRT and ACT were not linked).

Table 50. Examples from each sub-category relating to the Connection between the tasks

Sub-category	Example
Helpful	“Either way, doing well on that test did also make me feel better so it worked. I enjoyed this task”
No Connection	“Nothing substantial”

Discussion

Considering first the quantitative findings only, participants were consistently more hopeful (with SHS and THS improvements, including both THS sub-scales), and less negative after GRT engagement. A difference was also evident between Instructional conditions, with participants from the Explicit

condition having a small increase in PN (i.e., increased negativity) post-intervention. Bayesian evidence was particularly strong for the reduction in negativity (i.e., PN), suggesting this effect is reliable. In addition, baseline hope and positivity were established as predictors of GRT engagement, and GRT engagement as predictor of subsequent hope levels (particularly Agency).

ACT data was largely as expected (i.e., faster, more accurate, and more optimal as the task progressed) although no reliable differences emerged between Instructional conditions. Increased GRT engagement predicted faster RTs, although no relationships with Accuracy or Optimality were evident. However, hope and Optimality themselves were predictive; baseline State Hope levels predicted Optimality, and in turn, Optimality predicted Hope (State and Trait) by the end of the task. Bayesian evidence provided particular support for the predictive relationship between State Hope and Optimality, both pre-and post-intervention. Nevertheless, support for an association between Hope and CF was seen; those that are more hopeful, are also more Optimal (i.e., demonstrating flexibility in adapting to environmental changes).

The qualitative data consider alone suggest the GRT was an effective intervention, with no meaningful differences between Instructional conditions. However, the Explicit condition evidenced more mixed results, which highlighted both positive and negative aspects of goal-reflection. Focusing on AUT performance, Implicit condition participants appeared more aware of optimal behaviour, suggesting they switched targets as colour proportions changed.

Converging both data strands, participants who completed the GRT showed higher levels of 'positivity' (increased hope, decreased negativity), and behaviourally, demonstrated higher levels of CF. Naivety to GRT aims appears to have little effect, with only small differences between Instructional Conditions (for both qualitative and quantitative measures). Finally, given that GRT engagement correlated more optimal behaviour overall, (and optimality aligns most intuitively with CF performance in this paradigm), this provided more support for connection between Hope and CF.

Moving forwards, the impact of the GRT on AUT (Guildford et al, 1977) performance will be explored. This will allow the efficacy of the GRT to be further studied. Additionally, the impact of the GRT on more complex CF can be investigated as it has been established both here, and in Study 4, that little difference is seen in less complex CF (i.e., RT, Accuracy).

Chapter Summary

In contrast to the CST, the GRT elicits a number of behaviours that indicate more sustainable performance benefits, although not across all behavioural measures (e.g., faster responses, less accuracy). Hope (state and trait) was a predictor of Optimality, which arguably is the most intuitive CF behaviour emanating from ACT performance. Finally, GRT efficacy in improving levels of hope has been replicated in this second study.

Chapter 7: Exploring a Goal-Oriented Intervention and Cognitive Flexibility in the Alternative Uses Task

Building on Previous Studies

Across CST Studies (1-3), the most successful CF improvement was seen in conjunction with the Alternative Uses Task (AUT; Guilford et al, 1978). In summary, experimental participants performed better than controls in all measures, excepting Originality. Furthermore, qualitative data highlighted participant-perceived advantages of the intervention, with particular emphasis on Realised Strengths. Conversely, the negative impact of simple consideration of personal Weaknesses. Given the AUT was the only measure to demonstrate increased CF reliably thus far (and in relation to an admittedly low impact 'quasi- intervention) it is useful to test these previous behavioural and affective advantages alongside a more robust PP intervention; the GRT.

GRT efficacy (i.e., increasing hope, positivity, reducing negativity) has been substantiated in Studies 4 and 5. However, little to no evidence for improved CF was found. That said, in Study 5 a relationship between GRT performance and more complex CF behaviour (i.e., Optimality) emerged. Therefore, the pairing of the strongest PP intervention with the strongest instance of CF improvement may give clearer indication of the extent of this relationship.

The Current Study: Research Questions and Predictions

The primary aim of this study is to examine whether hope (instantiated via a goal-oriented intervention) demonstrates similar impact on cognitive performance (here, CF) as positive affect (i.e., BBH; Fredrickson, 2001). Thus, we can ask whether GRT assigned participants perform better on the CF task (here, the AUT; Guilford et al, 1977) than control counterparts? And, if performance differences emerge, does the instruction format (Explicit or Implicit) have any impact?

Preliminary evidence for GRT efficacy has been established above (see Studies 4 and 5). Therefore, we would expect further validation of this intervention; that is, 1) hope levels will increase, and 2) CF performance will improve, when the intervention is undertaken. Based on Studies 4-5, GRT engagement measures (i.e., number of words written) may also show a relationship between increased engagement (i.e., more words, and therefore more time and effort spent on task reflection) and increased levels of hope.

These two aspects will be combined in Study 6, to assess whether participants who engage more fully in the GRT also show better ACT performance. I anticipate both increased levels of hope post-intervention and enhancement CF performance (i.e., Fluency, Flexibility, Elaboration, and Error Rates); the same is not expected for Originality given previous findings (see *Study 3*). Participant knowledge of these aims and predictions (e.g., Latham, Stajkovic, and Locke; 2010; see Weis & Speridakos, 2011) suggests that this will not hinder increased hopefulness (or subsequent CF performance), and may, in fact, boost it. However, it is important to highlight that no evidence has supported this prediction thus far.

Overall, qualitative data will allow specific insight into participants' subjective experience of the GRT. Content analysis will enable evaluation of goal-reflection itself, and potentially, indicate any real-world value of the GRT intervention. In other words, evaluating this intervention will involve assessing whether it 'works', but also show whether it is an activity that participants enjoy, and/or will continue with of their own accord.

Method

Participants

Seventy-eight participants were recruited for this study³³ (66 female); age ranged from 18-34 years ($M = 19.56$; $SD = 2.65$). Forty-eight participants

³³ Originally eighty participants were recruited, however two were removed having failed to follow the experiments instructions

(61.5%) self-reported English as their first language, a further six (7.7%) reported Malay, and five (6.4%) reported Chinese, three each for French and Cantonese (3.8% respectively), and two each for Mandarin and Tamil (2.6% respectively) as their first language. The remainder reported Urdu, Spanish, Korean, Bengali, Polish, Turkish, Hungarian, Bulgarian, and Hindi as their primary languages (1.3% each). Participants were recruited from a panel of first year undergraduate psychology students at the University of Warwick, who each received course credit for their participation, or from University of Warwick volunteers, paid £6 for their participation.

Measures and stimuli

Questionnaires and GRT. Following Study 4 (see *Chapter 5*), an identical questionnaire battery (i.e., SHS, THS, PANAS, free-response questionnaire), and GRT format was used.

Alternative Uses Task (AUT). Following Study 3, an identical AUT (Guilford et al, 1978) procedure was used. More details of the rationale for use of this paradigm are included in the overview of the methodological issues for this thesis (see *Chapter 3*).

Design

A MM design was used for this study. For the experimental aspect (i.e., GRT effect on AUT performance), a 3 x 4 mixed factorial design was used. The between-participants factor was Instructional Condition (Implicit, Explicit, and Control), and within-participants factor was Section (One, Two, Three, Four). The dependant variables were Error Rate (%), Fluency, Flexibility, Originality, and Elaboration. For the observational element (i.e., exploration of GRT-related behaviour), engagement was measured by the number of words written by the participant. All questionnaires were recorded twice; before undertaking the GRT (T1), and after finishing the CF task (T2).

For the qualitative component of the study, the free-response questionnaire was administered to all participants. These data were collected to address two specific questions; 1) *what connection, if any, do participants discern between the GRT and the AUT?* and 2) *how do participants experience the GRT overall, and are there any apparent effects of goal reflection on goal achievement?*

Procedure

Participants were randomly allocated to one of the Instructional Conditions (Implicit, Explicit, or Control) and were given an information sheet, before fully informed consent was sought. Testing took place in individual sound- attenuated laboratory cubicles. To begin, all participants completed the SHS, THS, and PANAS (T1). Detailed instructions (see Stimuli & Measures section above) were then provided for either the GRT (i.e., Implicit, Explicit), or Typical Day (i.e., Control) task.

GRT Procedure. An identical procedure to Study 4 was used (pg. 149). In the Implicit instructional condition, participants were given an instruction sheet for the GRT, where they were asked to reflect on a goal they had previously achieved. No parameters for the goal were indicated, simply that it should be meaningful to the participant and had been achieved. Completion of the GRT was self-paced, and undertaken alone, with instructions to inform the researcher when finished. The Explicit instructional condition was identical to the Implicit condition, with one additional step. Before starting the GRT, participants were informed (by the researcher using a script) why they were being asked to complete the GRT, and what the expected outcomes were (e.g., increased hope, better performance on the subsequent ACT task). Finally, in the Control condition, participants given instructions for the Typical Day task, where they were asked to describe what they would consider to be a typical day. Similarly, once instructed, task performance was self-paced in isolation, with instructions to inform the researcher when finished.

AUT Procedure. An identical procedure to Study 3 was used (pg, 150). Following completion of the reflective task, participants were instructed for the Alternative Uses Task. They were informed verbally to read the instructions carefully, and to signal any questions before starting the task. Participants were informed that they would be presented with some common objects with a defined use (e.g., *newspaper; used for reading*), and that their task was to think of up to six alternative uses for each item. Participants were provided with a completed example for *newspaper*, and instructed to note each of the example uses listed were different from each other and from the primary use. Participants were presented with three items per section, with four minutes for each section; they could complete all three items in each section simultaneously, but they could not return once the four minutes were complete. Participants were given a chance to ask questions before the first section started.

Upon completion of the AUT task, participants were given the SHS, THS, and PANAS again (T2), plus the free-response questionnaire. Here, they were asked to reflect on the study as a whole, and describe any thoughts or feelings that occurred to them at any point during the study. In particular, participants were asked to comment on their experience of the GRT, any connection between the GRT and AUT performance, and any other resulting thoughts and/or feelings that arose.

Following data collection, frequentist analyses were conducted using SPSS (IMB Corporation, 2016). Bayesian statistical analyses were also conducted, using the free software JASP (version 0.9.0.1) and default priors (JASP Team, 2017; see *Chapter 3: Bayesian Analysis*) Free-response data were collated using nVivo (QSR International Pty Ltd, 2012), and analysed using a content analysis methodology (Hsieh & Shannon, 2005; Mayring, 2000).

Results

In order to simplify the structure of the following findings, this section has been divided into three subsections. Firstly, descriptive statistics are outlined, followed by the questionnaires and experimental data (i.e., descriptive statistics for the AUT, and subsequent inferential analyses). Next, Bayesian analysis is reported on AUT data, to ensure analysis of these data is as robust overall as the design allows³⁴. To avoid repetition of statistics, only noteworthy findings from the Bayesian analysis will be reported in detail. Finally, qualitative data are analysed using a Content Analysis approach, with textual presentation of the findings.

Reflective Tasks

Descriptive Statistics. Table 51 below displays the mean number of words written by participants, grand mean and item by item analysis³⁵. Participants in the Implicit condition wrote the most words ($m = 78.18$, $SD = 43.93$), and fewest in the Explicit condition ($m = 57.37$, $SD = 28.19$). Dispersion was substantial (mean collapsed across all conditions, $m = 65.52$, $SD = 34.72$), but similar across all groups.

Table 51. Mean number of words written by participants, by Condition

	Implicit		Explicit		Control	
	Mean	SD	Mean	SD	Mean	SD
Grand Mean	78.18	43.93	57.37	28.19	61.01	32.03
Q1	20.65	29.78	20.38	37.07	127.58	67.80
Q2	70.27	48.58	52.62	38.71	7.19	13.25
Q3	138.15	91.83	99.88	45.64	-	-
Q4	83.65	52.75	45.64	27.33	48.27	34.08

³⁴ Both in terms of experimental power and avoidance of Type 1 error, due to the number of analyses required by a complex design. Analysis of Effects are reported as BF_{inc} , and BF_{10} for correlational analyses.

³⁵ Descriptive data for all questions reported in Table 51, although only the 'Grand Mean' figure will be used from this point forwards as a measure of GRT engagement.

Frequentist Analysis. No differences with anecdotal evidence for the null hypothesis were seen in the average words written between Instructional Conditions as determined by a one-way ANOVA, $F(2, 77) = 2.57, p = .08, BF_{inc} = 0.80$.

Questionnaire data

Descriptive Statistics. All participants completed each questionnaire at two time points, once before (T1) and once after (T2) the GRT and AUT; the data are displayed in Table 52 below. Somewhat unexpectedly, all Instructional Conditions had a very small decrease in hope between T1 and T2 (collapsed across all factors, SHS difference $m = -.090$; THS difference $m = -.056$). Interestingly, the Implicit condition showed a similarly small increase in the Agency subscale between T1 and T2 (Implicit Agency difference, $m = 0.31$). However, a reduction in negativity was also found (collapsed across all factors, PN difference, $m = -1.49$). Overall, these results suggest a varied response to the GRT.

Table 52. Responses for SHS, THS (Agency and Pathway subscales) and PANAS (Positive and Negative subscales) at both T1, T2, by Condition

Questionnaire		Condition					
		Implicit		Control		Explicit	
		Mean	SD	Mean	SD	Mean	SD
T1	SHS	33.73	4.97	32.81	6.36	32.12	3.75
	PANAS Positive	32.85	6.96	33.73	7.12	29.58	7.22
	PANAS Negative	19.46	7.50	19.85	8.18	19.65	6.90
	THS	45.92	6.45	43.88	7.61	43.77	5.81
	THS Agency	21.62	4.91	21.62	4.62	21.35	3.52
	THS Pathway	24.31	3.70	22.27	4.13	22.42	3.34
T2	SHS	32.69	5.92	31.65	5.85	31.62	4.51
	PANAS Positive	32.27	8.72	32.54	7.40	30.27	6.92
	PANAS Negative	17.65	7.02	17.92	7.36	18.92	8.12
	THS	45.85	6.94	43.19	8.06	43.58	5.08
	THS Agency	21.92	4.68	21.31	4.84	21.27	3.27
	THS Pathway	23.92	4.27	21.88	4.25	22.31	2.92
Difference	SHS	-1.04	4.93	-1.15	5.48	-.50	4.26
	PANAS Positive	-.58	5.71	-1.19	4.65	.69	4.79
	PANAS Negative	-1.81	3.97	-1.92	4.46	-.73	4.34
	THS	-.08	4.73	-.69	3.52	-.19	4.76
	THS Agency	.31	2.24	-.31	1.67	-.08	2.80
	THS Pathway	-.38	3.34	-.38	2.37	-.12	2.41

*N = 26 per Condition.

Frequentist Analysis

Difference Between Questionnaire Score at T1 And T2. A mixed 2 x 3 ANOVA was conducted on the questionnaires (Figure 40), with within-participant factors of Time (T1, T2), and the between participants factor-Condition (Implicit, Explicit, and Control); the results are displayed in Table 53. A main effect of Time, with moderate evidence, indicates reduction in PN between T1 and T2 $F(1,75) = 9.48, p = .003, \eta^2 = .11, BF_{inc} = 11.37$. No further

effects or interactions were found, with anecdotal evidence for the null (all $F_s < 2.52$, all $p_s > .09$).

Table 53. Mixed ANOVA results for Time (i.e., differences in questionnaire results from T1 to T2), by Condition

Questionnaire	Effect	F	df	p	η^2	BF_{inc}
SHS	Time	2.60	1, 75	.11	.03	0.56
	Condition	0.57	1, 75	.57	.02	0.25
	Time * Condition	0.13	2, 75	.88	.00	0.13
THS	Time	0.42	1, 75	.52	.01	0.21
	Condition	1.11	1, 75	.34	.03	0.51
	Time * Condition	0.15	2, 75	.87	.00	0.12
Agency	Time	0.01	1, 75	.92	.00	0.17
	Condition	0.08	1, 75	.92	.00	0.38
	Time * Condition	0.48	2, 75	.62	.01	0.14
Pathway	Time	0.90	1, 75	.35	.01	0.29
	Condition	2.52	1, 75	.09	.06	1.09
	Time * Condition	0.31	2, 75	.92	.00	0.10
PP	Time	0.39	1, 75	.53	.01	0.21
	Condition	1.57	1, 75	.22	.04	0.62
	Time * Condition	0.93	2, 75	.40	.02	0.21
PN	Time	9.48	1, 75	.003**	.11	11.37
	Condition	0.07	1, 75	.94	.00	0.34
	Time * Condition	0.62	2, 75	.54	.02	0.18

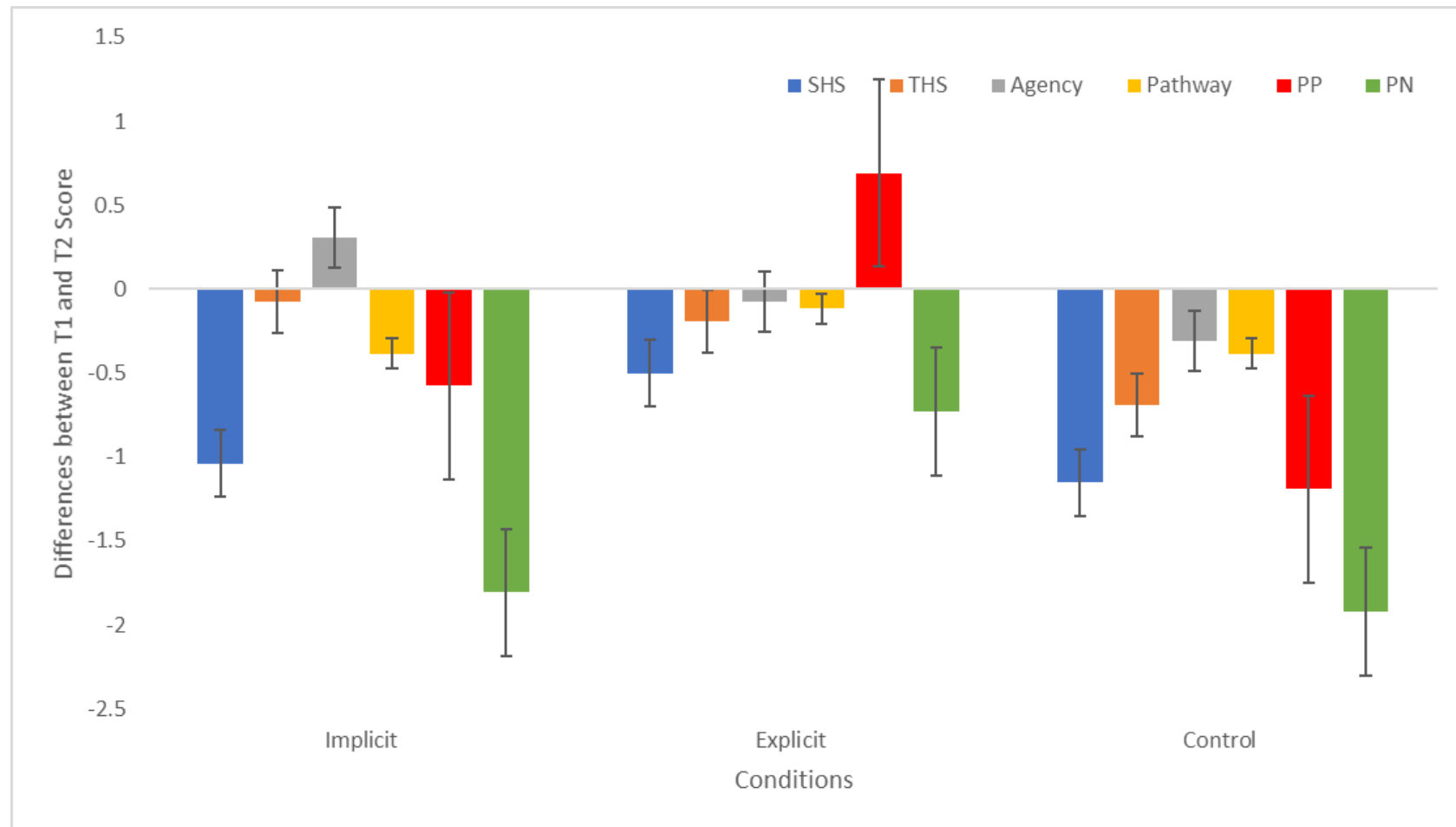


Figure 40. Graph depicting differences in Questionnaires scores between T1 and T2 by Condition. Error bars indicate ± 1 standard error of the mean.

GRT Relationship with Questionnaires. A Pearson's Product moment correlation was conducted to establish any associations between questionnaire scores (at both T1 and T2) and GRT engagement (see Table 54 below). Where correlations were statistically significant, simple linear regression analyses were used to calculate predictiveness of GRT engagement on questionnaire responses. GRT engagement was found to predict T2 Agency score ($t = 2.33$, $p = .023$, $R^2 = 0.07$, $BF_{10} = 2.35$). Agency score was equal to $19.50 + (0.03 \times \text{mean words})$, see Figure 41 below. However, Bayesian evidence in support of this relationship was only anecdotal.

Table 54. Correlational analyses between GRT engagement and questionnaires at T1 and T2

Time		Questionnaires					
		SHS	PP	PN	THS	Agency	Pathway
T1	r	.16	.15	-.07	.20	.21	.10
	p	.16	.19	.53	.09	.07	.36
T2	r	.12	.12	-.07	.15	.26*	-.02
	p	.29	.30	.57	.19	.02	.85

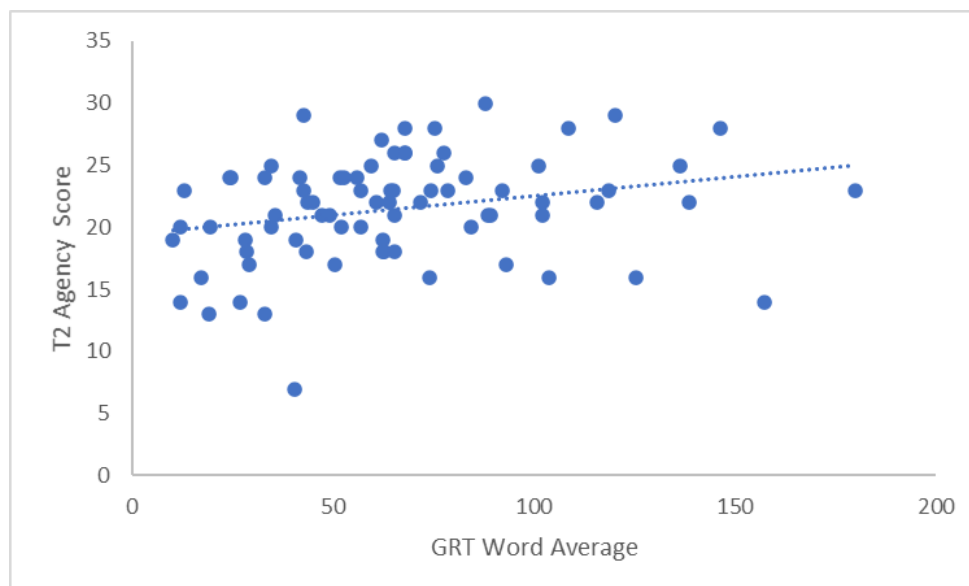


Figure 41. Line graph depicting relationship between Agency scores at T2, and average words produced for the GRT.

AUT data

Descriptive Statistics. No outliers were removed from the data.

Descriptive statistics for AUT performance are displayed in Table 55, paired with a short summary for each variable. Generally, the Implicit condition showed the best AUT performance (i.e., highest score, fewest errors).

Fluency. Across all sections, both GRT Conditions had similar scores. The Implicit condition had highest Fluency scores ($m = 2.48$, $SD = 0.95$), followed by the Explicit condition ($m = 2.37$, $SD = 0.88$), and the Control condition, the lowest ($m = 1.58$, $SD = 0.79$). All conditions decreased in performance over time (collapsed across conditions Fluency $m = 2.14$, $SD = 0.87$).

Flexibility. Across all Sections, the Implicit condition had the highest Flexibility score ($m = 1.99$, $SD = 0.67$), and the Control the lowest ($m = 1.22$, $SD = 0.55$), although with a narrow range of only 0.77. Again, all conditions had a decrease in performance between Sections 1 - 4, although notably, the Implicit condition showed a small numerical score increase in Section 2 ($m = 2.24$, $SD = 0.71$).

Elaboration. The Implicit condition again had the best performance, with the highest Elaboration score (grand $m = 1.05$, $SD = 0.44$), followed by the Explicit (grand $m = .82$, $SD = 0.65$), then Control (grand $m = .44$ $SD = 0.41$). Interestingly, all conditions had a slight increase in Elaboration score between Sections 1 and 2, although Section 4 had the lowest score for all conditions (Section 4 collapsed across Conditions $m = 0.70$, $SD = 0.56$). However, overall, this indicated an absence of a clear pattern.

Originality. Originality scores were generally low (collapsed across all factors, $m = 0.35$), with a range of only 0.21 between the highest (Explicit grand, $m = 0.44$, $SD = 0.34$), and lowest score (Control grand, $m = 0.23$, $SD = 0.29$).

Error Rate³⁶. Finally, the Implicit condition had the lowest error rate (grand $m = 15.24\%$, $SD = 15.51$). Notably, the Control condition did much worse, with an error rate of over 50% for both sections 3 ($m = 50.68$, $SD = 20.40$) and 4 ($m = 55.62$, $SD = 22.34$; grand $m = 44.50\%$, $SD = 22.42$). Similarly to other performance measures above, Accuracy became progressively worse with time, for all conditions (Section 1 collapsed by Condition $m = 18.72$, $SD = 19.21$, Section 4 collapsed by Condition $m = 35.81$, $SD = 21.36$).

³⁶ If a participant failed to provide any alternative uses for an item, then the Error Rate was recorded as 100%.

Table 55. AUT Fluency, Flexibility, Elaboration, Originality, and Error Rate (%), by Section and Instructional Condition

Instructional Condition*	Section	Dependant Variable									
		Fluency		Flexibility		Elaboration		Originality		Error Rate	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean (%)	SD
Implicit	1	2.64	.81	2.10	.64	1.17	.70	.43	.29	5.81	10.36
	2	2.56	.86	2.24	.71	1.18	.80	.29	.33	13.78	14.33
	3	2.36	.95	1.90	.68	.94	.77	.37	.35	19.06	17.05
	4	2.35	1.18	1.72	.65	.91	.58	.44	.29	22.31	20.31
	Grand mean	2.48	.95	1.99	.67	1.05	.71	.38	.32	15.24	15.51
Explicit	1	2.56	1.00	2.10	.72	.78	.82	.39	.29	20.24	20.42
	2	2.29	.93	1.96	.80	.91	.61	.39	.30	24.29	16.78
	3	2.28	.78	1.87	.60	.88	.65	.47	.38	26.30	22.75
	4	2.33	.79	1.69	.52	.72	.51	.51	.39	29.49	21.44
	Grand mean	2.37	.88	1.91	.66	.82	.65	.44	.34	25.08	20.35
Control	1	1.82	.96	1.42	.71	.44	.41	.21	.24	30.11	26.85
	2	1.62	.73	1.37	.52	.54	.53	.26	.34	41.58	20.09
	3	1.44	.62	1.13	.50	.38	.31	.12	.20	50.68	20.40
	4	1.44	.84	.96	.46	.38	.37	.31	.36	55.62	22.34
	Grand mean	1.58	.79	1.22	.55	.44	.41	.23	.29	44.50	22.42

*N = 26 per Condition

Frequentist Analysis

Fluency Data. A mixed 3 x 4 ANOVA was conducted on AUT Fluency data (Figure 42); the within-participants factor was Section (1, 2, 3, 4), and the between-participants factor was Instructional Condition (Implicit, Explicit, Control). There was a main effect with moderate evidence; Fluency was highest for Section 1 and Lowest for Section 3, $F(3,225) = 4.12$, $p = .007$, $\eta^2 = .05$, $BF_{inc} = 3.14$. Pairwise comparisons revealed Section 1 ($m = 2.34$, $SD = 0.99$) was higher than Section 3 ($m = 2.03$, $SD = 0.89$, $p = .016$); however, no other differences were found (all $ps > .07$). An effect of Condition was found, with extreme evidence, $F(1,75) = 13.33$, $p < .001$, $\eta^2 = .26$, $BF_{inc} = 1889.31$. LSD post-hoc analysis revealed both the Implicit ($m = 2.48$, $SD = 0.79$, $p < .001$) and Explicit ($m = 2.37$, $SD = 0.73$, $p < .001$) to have higher Fluency scores than the Control ($m = 1.58$, $SD = 0.51$), although there was no difference between Implicit and Explicit Conditions ($p = .569$). Finally, no reliable interaction was found, $F(6,225) = 0.27$, $p = .95$, $BF_{inc} = 0.02$; with strong evidence for the lack of an interaction.

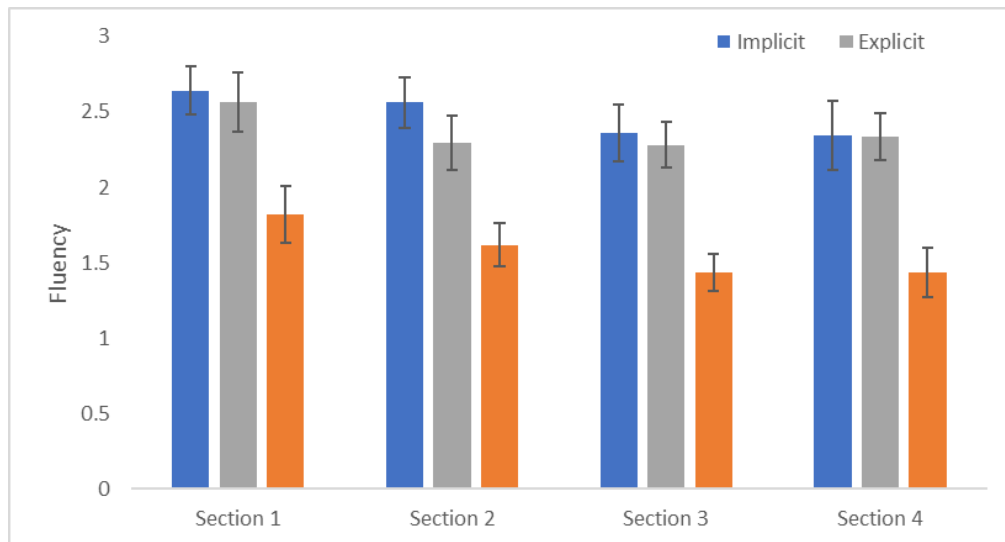


Figure 42. Graph showing Fluency, Section by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of GRT. A Pearson's Product Moment correlation was conducted to assess any relationship between Fluency and GRT engagement,

prior to regression analyses. No clear association was evident, $r(78) = .12$, $p = .29$, $BF_{inc} = 0.24$, and evidence to support the null hypothesis was anecdotal. Therefore, no regression analyses were calculated.

Predictiveness of Questionnaires. A series of Pearson's Product Moment correlations assessed possible relationships between Fluency and hope questionnaire scores at both T1 and T2 prior to any regression analyses (see Table 56 below). Fluency was found to be a predictor of T2 SHS ($t = 2.75$, $p = .007$, $R^2 = 0.09$, $BF^{10} = 5.67$). SHS score was equal to $27.56 + (2.06 \times \text{fluency score})$, see Figure 43. Bayesian analysis yielded moderate evidence to support the predictiveness of Fluency on post-intervention state hope. No relationship was found between Fluency and T1 questionnaires, or between Fluency and THS (including both subscales) at T2 (all $rs < .19$, all $ps > .10$, $BF_{inc} 0.16 - 0.53$). There was anecdotal evidence only to support the null hypothesis.

Table 56. Correlational analyses between questionnaires at T1 and T2, and Fluency

Time		Questionnaires			
		SHS	Agency	Pathway	THS
T1	r	.15	.05	.19	.14
	p	.20	.22	.66	.10
T2	r	.30*	.13	.19	.19
	p	.007	.10	.25	.10

* = significant $< .05$

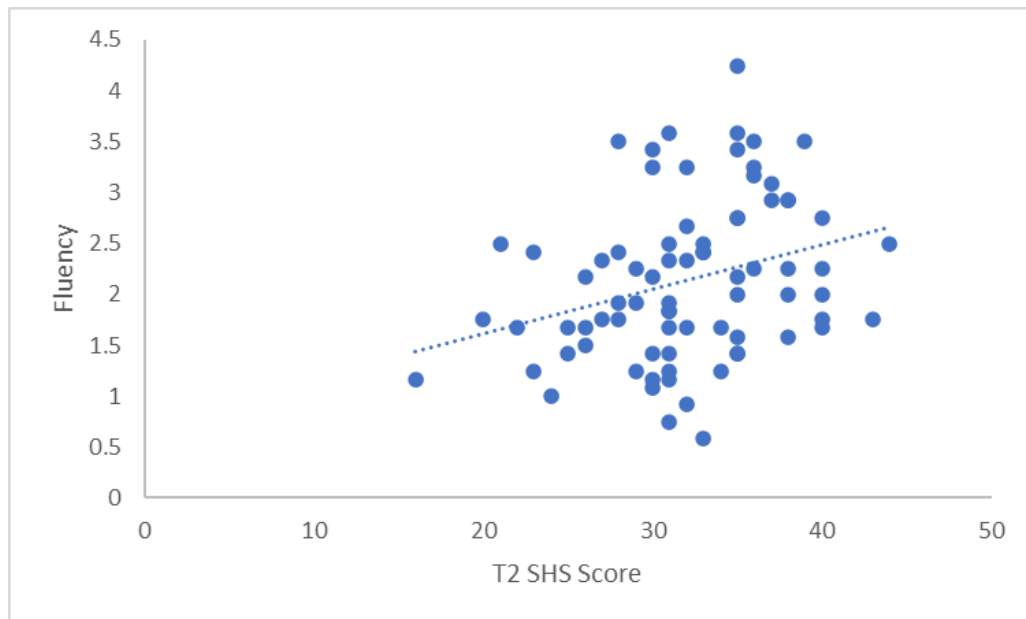


Figure 43. Line graph depicting relationship between SHS scores at T2, and average Fluency.

Flexibility Data. A mixed 3 x 4 ANOVA was conducted on AUT Flexibility scores (Figure 44); the within-participants factor was Section (1, 2, 3, 4), and the between-participants factor was Condition (Implicit, Explicit, Control). A main effect of Section, with extreme evidence, indicates Flexibility was highest for Section 1 and Lowest for Section 4, $F(3,225) = 13.54$, $p < .001$, $\eta^2 = .15$, $BF_{inc} = 394610.41$. Pairwise comparisons revealed more Flexibility Section 1 than Sections 3 ($p = .02$) and 4 ($p < .001$). Section 2 was also had Flexibility than Sections 3 ($p = .03$) and 4 ($p < .001$), with to Section 3 scoring higher on Flexibility than Section 4 ($p = .043$).

In addition, there was a main effect of Condition, supported by Bayesian-based extreme evidence, $F(1,75) = 20.20$, $p < .001$, $\eta^2 = .35$, $BF_{inc} = 144394.28$. LSD post-hoc analysis revealed both the Implicit ($p < .001$) and Explicit ($p < .001$) to have higher Flexibility scores than the Control, although there was no difference between Implicit and Explicit Conditions ($p = .53$). Finally, there was no interaction, $F(6,225) = 0.54$, $p = .78$, $\eta^2 = .01$, $BF_{inc} = 0.03$, with strong evidence indicating that the factors do not interact.

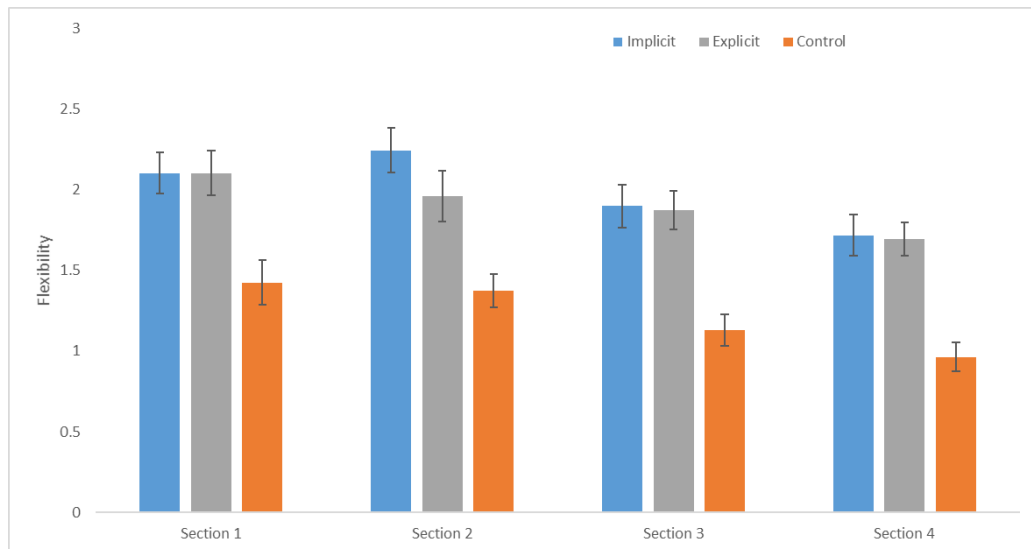


Figure 44. Graph showing Flexibility, Section by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of GRT. A Pearson's Product Moment correlation was conducted to assess any relationship between Flexibility and GRT engagement prior to regression analyses. No relationship was found, with anecdotal evidence in support of the null hypothesis, $r(78) = .14$, $p = .22$, $BF_{inc} = 0.45$; therefore no regression analyses were calculated.

Predictiveness of Questionnaires. A series of Pearson's Product Moment correlations were conducted to assess any relationships between Flexibility and hope questionnaire scores at both T1 and T2, prior to any regression analyses (see Table 57). Flexibility predicted T2 SHS ($t = 2.22$, $p = .029$, $R^2 = 0.06$). SHS score was equal to $28.09 + (2.28 \times \text{Flexibility score})$, see Figure 45. However, Bayesian analysis indicates only anecdotal evidence to tentatively support this predictive relationship was found ($BF = 1.48$). There were no relationships between Flexibility and any T1 questionnaire scores, and no relationship between Flexibility and THS (for either sub-scale) at T2 (all $rs < .15$, all $ps > .18$); all Bayesian evidence was anecdotally in support of the null hypothesis ($BF_{inc} = 0.14 - 0.39$).

Table 57. Correlational analyses between questionnaires at T1 and T2, and Fluency

Time		Questionnaires			
		SHS	Agency	Pathway	THS
T1	<i>r</i>	.08	.02	.15	.10
	<i>p</i>	.51	.85	.19	.38
T2	<i>r</i>	.25*	.09	.15	.14
	<i>p</i>	.03	.46	.18	.22

* = significant <.05

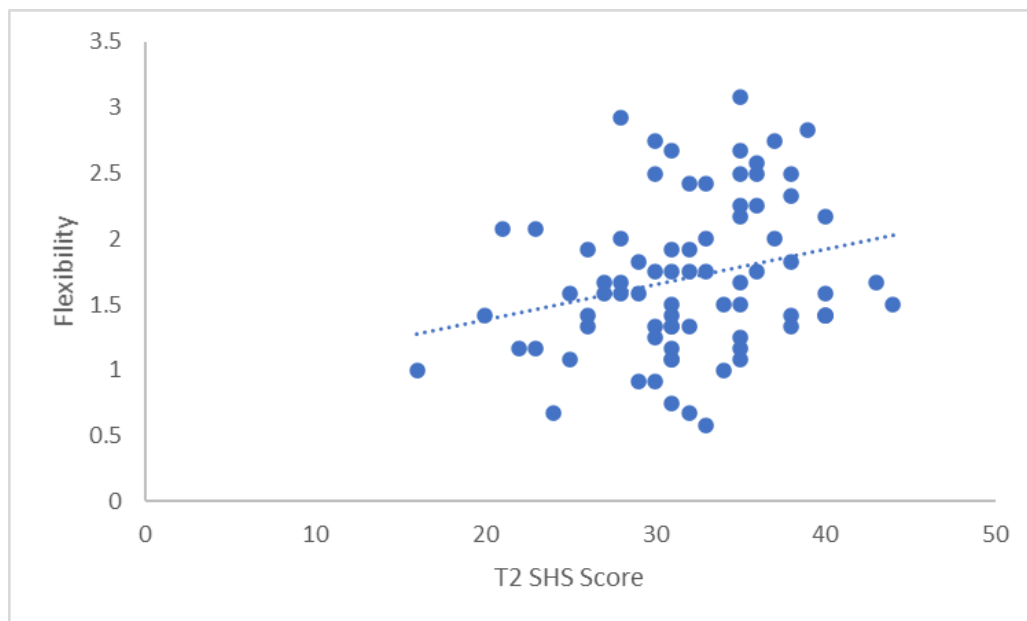


Figure 45. Line graph depicting relationship between SHS scores at T2, and average Flexibility.

Elaboration Data. A mixed 3 x 4 ANOVA was conducted on AUT Elaboration data (Figure 46); the within-participants factor was Section (1, 2, 3, 4), and the between-participants factor was Condition (Implicit, Explicit, Control). There was a main effect of Section, the highest scores for Elaboration in Section 2 and Lowest in Section 4, $F(3,225) = 2.88$, $p = .04$, $\eta^2 = .04$, $BF_{inc} = 0.70$. Pairwise comparisons revealed more elaboration in Section 2 than Section 4 ($p = .024$); but there were no other differences (all $ps > .35$). However, Bayesian evidence anecdotally supported the null hypothesis.

The main effect of Condition achieved statistical significance, with extreme evidence in support, $F(1,75) = 11.52$, $p < .001$, $\eta^2 = .24$, $BF_{inc} = 582.85$. LSD post-hoc analysis revealed both Implicit ($p < .001$) and Explicit ($p = .004$) conditions had higher Elaboration scores than the Control, although there was no difference between Implicit and Explicit Conditions ($p = .09$). Finally, there was no interaction, $F(6,225) = 0.72$, $p = .64$, $BF_{inc} = 0.03$, with strong evidence to indicate the factors do not interact.

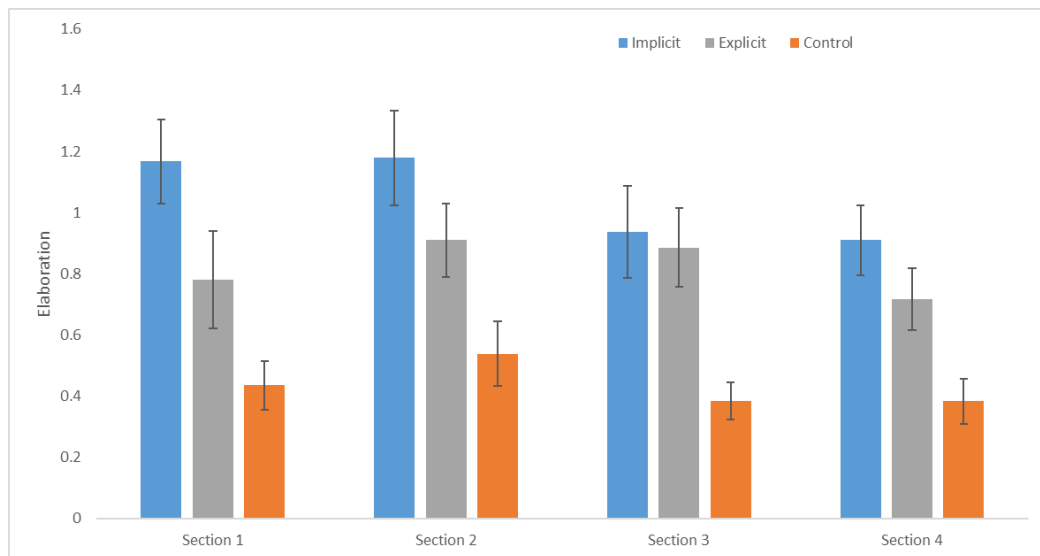


Figure 46. Graph showing Elaboration, Section by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of GRT. A Pearson's Product Moment correlation assessed any relationship between Elaboration and GRT engagement prior to regression analyses. A simple linear regression was conducted, with GRT engagement predicting Elaboration ($t = 2.51$, $p = .01$, $R^2 = 0.07$, $BF_{inc} = 3.43$); Elaboration score was equal to $0.51 + (.004 \times \text{Word Average})$; see Figure 47 below. Moderate evidence was found to support the predictiveness of participant engagement (i.e., words written) on Elaboration score.

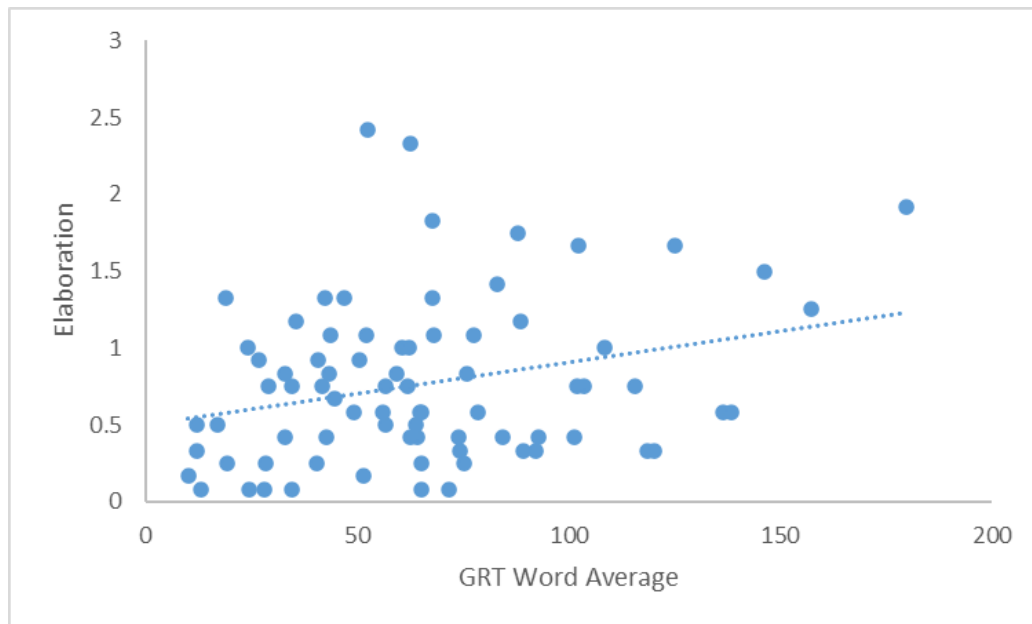


Figure 47. Line graph depicting relationship between Elaboration scores, and GRT word average.

Predictiveness of Questionnaires. A series of Pearson's Product Moment correlations were conducted to assess any relationships between Elaboration and hope questionnaire scores at both T1 and T2. prior to any regression analysis. No relationships were found (all $r_s < .19$, all $p_s > .29$, $BF_{inc} = 0.14 - 0.24$), therefore no regression analyses were conducted. Anecdotal evidence in support of the null was found for all relationships.

Originality Data. A mixed 3 x 4 ANOVA was conducted on AUT Originality data (Figure 48); the within-participants factor was Section (1, 2, 3, 4), and between-participants factor was Condition (Implicit, Explicit, Control). There was a main effect of condition, with strong evidence, $F(1,75) = 7.32$, $p = .001$, $\eta^2 = .16$, $BF_{inc} = 21.83$. LSD post-hoc analysis revealed both the Implicit ($m = 1.16$, $p = .008$) and Explicit conditions ($m = 1.21$, $p < .001$) had higher Originality scores than Control ($m = 0.44$), although there was no difference between Implicit and Explicit Conditions ($p = .34$). There was no effect of Section, $F(3,225) = 2.31$, $p = .07$, $BF_{inc} = 0.28$, and no interactions achieved statistical significance, $F(6,225) = 1.31$, $p = .25$, $BF_{inc} = 0.12$.

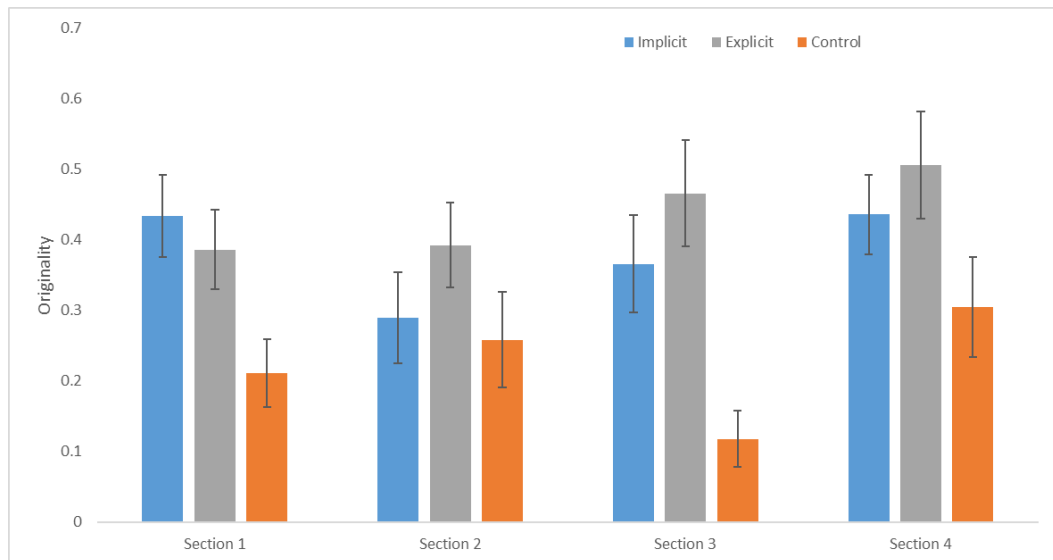


Figure 48. Graph showing Originality, Section by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of GRT. A Pearson's Product Moment correlation was conducted to assess any relationship between Originality and GRT engagement prior to regression analyses. There was no relationship, supported by anecdotal evidence for the null hypothesis, $r(78) = .004$, $p = .97$, $BF_{inc} = 1.76$. Therefore, no regression analyses were calculated.

Predictiveness of Questionnaires. A series of Pearson's Product Moment correlations were conducted to assess any relationships between Originality and hope questionnaire scores at both T1 and T2, prior to any regression analyse. There were no statistically significant associations (all $rs < .17$, all $ps > .13$, $BF_{inc} = 0.14 - 0.42$), therefore no regression analyses were undertaken. Anecdotal evidence in support of the null was found for all correlational analyses.

Error Rate. A mixed 3 x 4 ANOVA was conducted on AUT Accuracy data (Figure 49); the within-participants factor was Section (1, 2, 3, 4), and the between-participants factor was Condition (Implicit, Explicit, Control). There was a main effect of Section, $F(3,225) = 14.86$, $p < .001$, $\eta^2 = .17$, $BF_{inc} = 1.73$, with Error Rate lowest for Section 1 and highest for Section 4. Pairwise comparisons revealed Section 1 to be more accurate than Sections 2, 3, and 4 (all $ps < .02$),

and Section 2 to be more accurate than Section 4 ($p = .006$); no other differences were found (all $ps > .26$).

Similarly, there was a main effect of Condition, $F(1,75) = 32.42$, $p < .001$, $\eta^2 = .46$, $BF_{inc} = 1.98$. LSD post-hoc analysis revealed both the Implicit ($p < .001$) and Explicit conditions ($p < .001$) had higher accuracy scores than the Control, and Implicit to be more accurate than the Explicit Condition ($p = .01$). However, as both main effects for Condition and Section only achieved anecdotal evidence, these findings should be interpreted cautiously. Finally, there was no interaction, $F(6,225) = 1.25$, $p = .28$, $\eta^2 = .03$, $BF_{inc} = 0.10$.

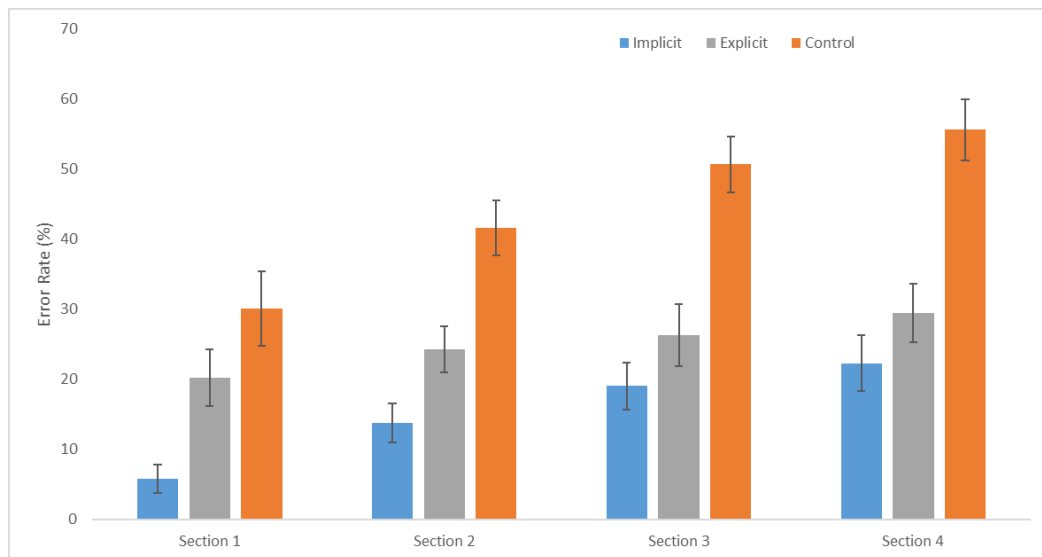


Figure 49. Graph showing Error Rate, Section by Condition. Error bars indicate ± 1 standard error of the mean.

Predictiveness of GRT. A Pearson's Product Moment correlation was conducted to assess any relationship between Error Rate and GRT engagement prior to regression analyses. A simple linear regression was conducted, and GRT engagement was found to be a predictor of Error Rate ($t = 8.73$, $p = .03$, $R^2 = 0.06$, $BF_{inc} = 1.76$); Error Rate was equal to $36.16 - .12 \times \text{Word Average}$, see Figure 50. However, evidence was anecdotal only, suggesting caution in evaluating this relationship.

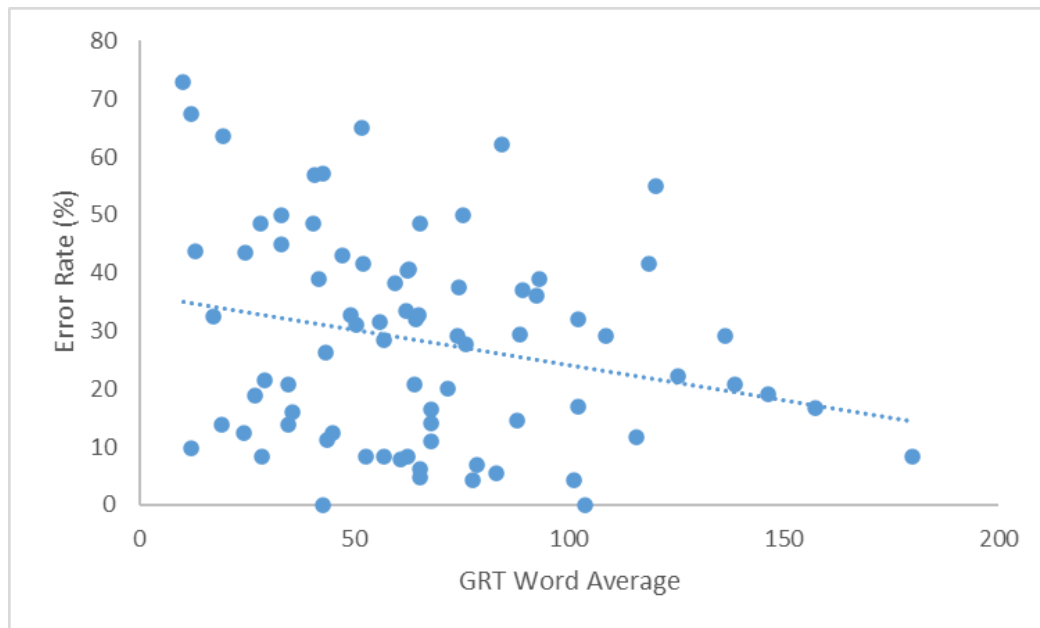


Figure 50. Line graph depicting relationship between Error Rate, and GRT word average.

Predictiveness of Questionnaires. A series of Pearson's Product Moment correlations were conducted to assess any relationships between Originality and hope questionnaire scores at both T1 and T2, prior to any regression analyse. There were no statistically significant associations (all $r_s < .09$, all $p_s > .43$, $BF_{inc} = 0.14$ to 0.19); therefore no regression analyses were conducted. A Bayesian analysis was consistent with these results, with anecdotal evidence in support of the null for all relationships.

Qualitative Data

Free-response questionnaire. Participants' responses to the free response questionnaire were analysed using the same methodology as Study 4³⁷. A top-down content analysis was conducted to address two questions, 1) how do participants feel about the GRT task? And 2) what (if any) impact do they think it may have on subsequent performance? Importantly, qualitative analysis procedures (Braun & Clarke, 2006) recommend acknowledgement of implicit bias arising from prior analyses. Thus, while this content analysis was conducted

³⁷ Given the 'top-down' analysis, categories found in previous studies (i.e., 1-4) were considered and where similarities occurred, identical category names were used. Note: previous categories were not considered restrictive, and new codes and categories were formed where appropriate.

following standardised procedures, findings from Studies 4-5 use of the GRT will have influenced (or are highly likely to have influenced) the analysis. On a pragmatic level, categories identified in previous analyses do not constrain this analysis (i.e., new, previously undefined categories have been used), but where similarities have occurred, this has been noted (e.g., via identical category names).

Reflecting on a Goal. Two categories were identified in the responses: Positive and Neutral. Overwhelmingly, the majority of codes were identified within the Positive category, with three subcategories: 1) *Motivational*, 2) *Awareness of Accomplishments*, and 3) *Effective Reflection*. Participants particularly emphasised the motivational nature of the GRT in boosting action toward current goals. In addition, participants taking time to reflect on a time where they have attained a goal, enabled them to ‘feel good’, and reinforce belief they are able to achieve their goals. Further, effectiveness of the GRT indicates, somewhat self-referentially, that it was considered positive in nature, even beyond its ‘natural remit’ (i.e., working toward future attainment).

The Neutral category highlighted an arguably more balanced reaction from participants, with responses indicating both positive and negative aspects of goal reflection. Both Implicit and Explicit Instructional Conditions were equally represented in each category, suggesting similar experience across both experimental conditions.

Table 58. Examples of each of the Sub-Categories relating to the reflective tasks

Category	Sub-category	Example
Positive	Motivational	“My mind is opened as i usually move on in life after my dreams are achieved. I feel motivated after reflecting my own stories to myself. I can feel all the struggles I have been through, the moments I felt proud, afraid, enthusiastic and tired. But in the end everything goes in well [SIC]”
	Effective	“It felt good, I don't think I think about the good things enough so it was really nice”
	Reflection	“It was good, provided me with an opportunity to reflect on my progress thus far, as well as a way to focus on my successes as opposed to the failures I may have experienced on the way to success”
Neutral	Awareness of accomplishments	
Neutral	Balanced Reaction	“Made me feel nervous and worried recalling the problems before the goal but very proud thinking about reaching the goal itself”

Impact of GRT. In considering what, if any, impact of the GRT participants perceive, two categories emerged: 1) *General Behaviour* (i.e., beyond the scope of the study), and 2) *AUT Performance*. Of note, very few responses could be coded within the *General Behaviour* category, as participants appeared to focus more on potential impact on AUT performance.

Regarding *General Behaviour*, two sub-categories were identified (see Table 59). The majority of the codes within the *Impactful* sub-category were from Implicit condition participants, highlighting a general sense of confidence-building. A smaller number of codes made up the *Indifferent* sub-category, with participants suggesting the GRT lacked lasting impact. However, these codes were not necessarily consistent, with the same participants highlighting

‘theoretical’ benefits of the GRT; this suggested existence of some perceived benefit, whether experienced or not.

Table 59. Example of each sub-category relating to general impact of the GRT

Sub-category	Example
Impactful	“I do. It builds self belief and takes you through the logical problem solving you have previously used in order to repeat this again”
Indifferent	“I don't think it directly will help achieve said goal but it will certainly be a motivating factor. In the sense, you'd know that if a certain amount of hard work is put into achieving a goal, it will pay off for sure”

For specific impact on AUT performance, one notable subcategory (*Helpful*) was identified, suggesting that the GRT supported AUT performance (Table 60). That is, participants discussed how the GRT enabled them to feel more creative, and enhance performance (in comparison to not undertaking the GRT). Notably, although a small sub-category, this mostly comprised Implicit condition responses.

Table 60. Examples from each sub-category relating to the Connection between the tasks

Sub-category	Example
Helpful	“Thinking of my goals was beneficial, I felt pushed to be creative and think outside the box”

Discussion

Considering quantitative findings only, there was a decrease in negativity following GRT intervention. The GRT condition was also predictive of Trait Hope Agency, post-intervention. However, and unexpectedly, no differences in hope were seen for any Instructional condition. AUT data showed the behavioural differences between the conditions, with both GRT Instructional conditions

(Implicit and Explicit) performing better than Control, although not from each other. Further, participants were seen to be more Fluent, Flexible, Elaborative, and make fewer errors after completing the GRT. Bayesian evidence supports these claims (c.f. Error Rate), with moderate through to extreme evidence to indicate the differences between conditions. Support was also evident for association between CF (here, measured by AUT performance), and hope, with AUT performance predictive of state hope (SHS). In addition, Elaboration was predictive of GRT engagement; intuitively, it follows that participants who reflect and therefore write more in the GRT may also tend to elaborate more in their general behaviour.

Considered alone, the qualitative findings highlighted the beneficial nature of the intervention, generally and regarding AUT performance. Participants indicated feelings of more confidence or being encouraged to work towards current goals, in addition to general enjoyment of the task.

Converging the data strands, the findings provide potential evidence to support an ‘undoing effect’ (Fredrickson, 2001) elicited by the GRT, as indicated by literature on the BBH (Fredrickson, 2001; see Chapter 1). While no increase in hope was seen quantitatively, participants showed a reduction in negativity, and increased CF, as shown by improved AUT performance. Thus, we can suggest the GRT potentially activated a BBH-style *undoing effect*, allowing participants improve levels/quality of CF, but at a behavioural cost of hope levels; that is, putative task-related stress were ‘undone’. Beyond this, these data provide additional support for GRT efficacy in improving CF. With the exception of Originality measures, experimental participants showed better AUT performance, and reported perceived GRT enhancement of AUT performance.

However, the interesting relationship between increased CF, GRT performance, and hope levels should not be overlooked. Out of the four measures that increased, two were associated positively with SHS (i.e., Fluency and Flexibility predicted SHS at T2), and two were associated positively with GRT performance (i.e., higher GRT engagement predicted both Elaboration and Error

Rate). Meaning that these three factors appear to be reliably connected, at least within the context of this study.

GRT: Reviewing the Evidence

Considering data from Studies 4-6 collectively, there is converging support for GRT efficacy. Evaluating subjective experience, intervention participants, particularly those in the Implicit instruction condition, viewed the GRT as a positive, beneficial activity overall. Outside quantitative measurement, perception of an intervention as positive (i.e., enjoyable) has its own merit, and fits within the parameters of PP interventions established in the literature (e.g., Niemiec, 2018; Meyers et al, 2012; see *Chapter 4*).

Quantitatively speaking, the GRT improves hope levels effectively, and decreases negative affect. For CF specifically, a similar trend was seen as with the CST: as complexity demands of the CF task increased, so did GRT impact. That is, little to no effect is seen when CF is measured by simple behavioural responses (i.e., RT, Accuracy), yet when behavioural responses require more behavioural choice and creativity (i.e., Optimality, Fluency), GRT participants outperform control participants. However, this relationship does not appear entirely straightforward. For example, the GRT increased hope when combined with the ACT (Study 5), and although no differences emerged between conditions, these increases in hope did predict ACT performance. The potential interconnectedness of these factors is discussed further below (see *General Discussion*).

The impact of the instructional conditions (i.e., Implicit, Explicit) can also be examined in more detail. Despite making no specific predictions, a review of the literature (e.g., Latham, Stajkovic, and Locke; 2010; Weis & Speridakos, 2011; see *Chapter 5/Study 4*) suggested that awareness of GRT aims should not hinder performance, and might have boosted it. For Studies 4-6, this is clearly not the case. No meaningful quantitative differences were seen between Implicit and Explicit Conditions. Moreover, quantitative data suggests similar experiences of

participants in both conditions, although negative categories were more prevalent in responses from Explicit participants.

While no conclusive findings can be drawn, they do emphasise the complexity of intervention implementation. A similar conclusion was drawn by Crossley (2001) in a review of health intervention literature. Crossley suggested that interventions may fail when they challenge typical behaviour, as this ‘imposes’ a moral value (i.e., the health professional is *right*, therefore the participant is *wrong*). Put simply, by telling participants what they *should* do, they may become aware that both the opposite is possible, or that their typical behaviour falls into the ‘wrong’ category. While addressing this phenomenon is beyond the scope of this thesis, it does highlight an interesting future direction for PP interventions more generally.

Chapter Summary

Additional evidence supported the effectiveness of GRT interventions, 1) in reducing negativity, 2) in GRT performance predicting (Agency), although this was not reflected in statistically robust differences. Additionally, experimental participants showed improved CF (here, measured by AUT performance), compared to controls. Finally, convergence of quantitative and qualitative data confirmed the key findings of this chapter.

Chapter 8: Dear Diary: Evaluating A Goal-Oriented Intervention Linked with Increased Hope and Cognitive Flexibility

The following chapter was originally published in *The Journal of Personality and Individual Differences* (Hodson, MacCallum, Watson & Blagrove, 2021). It has been included in full below to preserve the integrity of the publication (cf. abstract and reference list; see *Declaration of Published Work*, pg. 16). However, naturally this entails a number of differences (i.e., in style, presentation format etc.) attributable to meeting the journal's requirements³⁸.

The study expands on findings from Studies 4-6, exploring daily goal-setting, attainment, and reflection (in adapted GRT format). Moreover, this study is consistent with the overarching aims of the thesis (i.e., activating the BBH via character strengths interventions, extending the operation of BBH to CF, etc.; see *Abstract/Aims and Objectives*). Most importantly, it allows insight into these questions via examination in a more naturalistic environment (i.e., not a laboratory).

An additional section (*Supplementary Analysis*) has been included at the end of this chapter. The paper included suggestions for future research based on exploration of goals and motivations, and what may be gained by exploring these concepts. While this was beyond the scope of the original article (and constrained by publication requirements etc.), the additional analysis provides unique understanding of goal-setting and other goal-oriented behaviour, not previously covered by Studies 4-6. The centrality of goal-setting to the second half of this thesis emphasises the relevance of the supplementary analysis here.

³⁸ Note, table and figures numbers have been changed to remain consistent with the thesis.

Introduction

The Role of Hope

Hope can be defined as the ability to successfully achieve one's goals; in particular, by maintaining motivation and overcoming obstacles (Snyder et al., 2002; see Callina, Snow, & Murray, 2017 for an overview). Here, *goals* are short-to-long term targets set by an individual, ranging widely in their personal significance, importance, and specificity (Rand & Cheavens, 2009). Specifically, in Snyder and colleagues' model, hope manifests in two ways; *pathways* and *agency*. *Agency* (or motivation), enables an individual to mentalize the ability to reach their desired goal, whereas *pathways* denote the ability to overcome obstacles that might prevent goal attainment. While both components contribute to hope, Snyder (1994) posits that it is the *interaction* between them that drives an individual's hopefulness (but cf. Tong, Fredrickson, Chang & Lim, 2010; for an alternative perspective). In other words, to demonstrate hope, one must be able to plan a route to achieve a goal, and maintain the motivation to achieve it, even when the plan needs to be adapted.

However, the real-world implications of hope have been explored beyond simple goal attainment, to include corollary behavioural effects. For example, hope was associated with better workplace engagement (Reichard, Avey, Lopez, & Dollwet, 2013), in particular, effective, pro-social, behavioural goal-setting. In academic contexts, hope predicts student performance (e.g., improved grades, decreased drop-out rates; Snyder et al., 2002), with higher levels of hope associated with higher overall academic achievement (Ciarrochi, Heaven, & Davies, 2007). In addition, hope and religious faith are positively correlated (Sethi & Seligman, 1993); people who practiced/engaged with their faith daily demonstrated higher levels of hope (Berthold & Ruch, 2014).

Behavioural benefits of hope extend to physical impact, including links to improved healthful behaviours (e.g., better focus on weight loss-

related activity; Nothwehr, Clark, & Perkins, 2013), and increased athletic performance (Curry, Snyder, Cook, Ruby, & Rehm, 1997). Further, higher hope levels have been associated with improved levels of mental health, including increased happiness and decreased negativity (see Alarcon, Bowling, & Khazon, 2013 for a review); increased subjective (Park, Peterson, & Seligman, 2004) and psychological (Gallagher & Lopez, 2009) well-being have also been reported.

A theoretical model through which hope can be explored is the Broaden and Build Hypothesis (BBH; Fredrickson, 2001) which accounts for the postulated ‘undoing effect’ of positivity (e.g., countering the effects of negativity such as narrowing of attention). This suggests the role of positive affect is to ‘broaden and build’ individuals’ thought-action repertoires (T-AR); more simply, boosting the ‘resource bank’ needed to engage with one’s environment in novel and creative ways, while continuing to build up these available resources. This perspective aims to account for behaviour that classical evolutionary theory (e.g., threat-based orientation to negative stimuli, fight, flight or freeze responses; Fredrickson, 2001) fails to address. Potentially, BBH can be extrapolated to our understanding of hope and its applications. In other words, hopeful thinking behaviour is intrinsically positive and may lead to positive affect (also vice versa, positive affect may lead to increased hope), and arguably, the adaptive functions outlined above.

This adaptive behaviour meshes with more traditional (e.g., philosophical, religious) views of hope as a virtue to be cherished (Callina et al., 2017; Gallagher, 2017), and earlier psychotherapists’ (e.g., Frank, 1968; Tiger, 1979) perspectives on hope as a powerful cognitive resource necessary for human development. However, the link between positivity and goal-achievement is not restricted to hope or the BBH per se. In fact, goal-orientation and responses to achieved/frustrated goal-directed actions have been suggested as elicitation mechanisms for human emotion (e.g., an achieved goal leads to happiness, a frustrated goal leads to anger

etc., Bagozzi & Pieters, 1998). This provides insight into a potentially reciprocal process where affect, intention and motivation influence our goal attainment, but the goal-oriented behaviour itself influences our subsequent affective behaviour (see Snyder, Feldman, Taylor, Schroeder, & Adams, 2000, for a hope-based example). These ideas suggest that there exists a complex interrelation between the individual behavioural and affective components that characterize hope as a construct.

Although hope (and more generally, BBH) have been examined in relation to goal-directed behaviour and cognition, one domain that remains relatively unexplored is cognitive flexibility (CF). This phenomenon, broadly understood as thinking creatively and adapting quickly to new circumstances can be taken to subsume a number of higher cognitive functions; for example, planning, monitoring problem-solving, switching between cognitive sets in task performance, and inhibition of no-longer-relevant strategies. However, the literature on CF- even broadly defined- offers mixed evidence for its correlates. For example, Yu and Lee (2017) reported a positive association between CF and hopelessness whereas Muyan-Yilik and Demir (2019) found a positive association between CF and dispositional hope. Additionally, their findings reinforced the idea of a connection between hope and subjective wellbeing (SWB), however, none was found between CF and SWB. One possible reason for this inconsistency may reflect use of a questionnaire to measure CF. While this approach is valid and robust (see Dennis & Vander Wal, 2010), by definition, CF entails deliberate, highly adaptive and creative thinking which may not be consistently captured via self-report questionnaires. In contrast, more naturalistic, ecologically-sound measures may increase both insight and consistency; fluency tasks (e.g., Alternative Uses Task; Guilford, Christensen, Merrifield, & Wilson, 1978) offer effective evaluation of the processes involved in CF. Thus, a fluency task paradigm that uses ecological CF (i.e., creative and adaptive thinking) might avoid the potential limitations of questionnaire-based designs.

Can Hope Be Increased?

If hope plays an important role in improving health, wellbeing and potentially, adaptive behaviour (i.e., via extended T-AR; Frederickson, 2001), then boosting hope within the general population could be considered a priority. Indeed, hope theory has been successfully applied in therapeutic and clinical settings, delivered by individual- and group-focused programs (Ciarrochi et al., 2007; Cheavens, Feldman, Gum, Michael, & Snyder, 2006). Among other outcomes (e.g., increased self-esteem, meaning in life), an increase in agency thinking was found.

Therapeutic techniques may focus on developing agency- and pathways-thinking separately, as both traits are highly correlated, but distinct (Cheavens & Guter, 2017). For example, pathways can be enhanced through goal-mapping activities, where individuals are encouraged to evaluate routes to a goal in order to identify the optimal one. In contrast, agency interventions focus on developing goal-focused motivation, adjusting thought patterns that may cause goal pursuit to falter. These interventions also focus on the goal-setting process itself (e.g., assessing 'Goldilocks' just-right goals or 'stretch' goals); these challenge the individual to develop and increase the likelihood of self-concordant (i.e., personally relevant) goals being set (see also Pedrotti, Edwards, & Lopez, 2008). Such goals are more likely to be achieved, creating a positive feedback-loop, with higher levels of agency-and pathways-thinking evident (Koestner, Lekes, Powers, & Chicoine, 2002). Thus, we can suggest that supporting all facets of goal-directed action (i.e., goal-setting, motivation, obstacle-avoidance, attainment-orientation) may positively influence overall levels of hope in the individual.

Methods like those in therapeutic settings have also been applied more broadly, indicating their potentially wider remit. In an educational context, the *Making Hope Happen* program (see Pedrotti et al., 2008) found that children's levels of hope increased over a five-week

intervention. Children were guided through various activities (e.g., The Hope Game; participants collect both 'pathway' and 'willpower/agency' cards, bolstering the need for both in order to progress) aimed to augment trait hope. Similarly, Marques, Lopez, and Pais-Ribeiro (2011) conducted a group-based, five-week long intervention designed to develop goal conceptualisation, setting, and attainment, which led to post-intervention increases in hope.

One-off sessions have also proved effective; following a 90-minute goal-oriented intervention, college students increased in hope and progressed better towards goal attainment (Feldman and Dreher, 2012). Supporting this design, meta-analysis by Weis and Speridakos (2011) found that hope levels improved more with single session interventions in a laboratory setting (27 studies were included; seven studies were one-off interventions, 19 were multi-session). However, they suggested this disparity could be explained by delivery of sustained interventions in clinical settings. Thus, typical participants (i.e., from clinical populations) may respond less to hope enhancement strategies, regardless of delivery method. This suggests a 'middle ground', to date, less frequently examined; sustained intervention could be delivered to a non-clinical population over a comparatively short period (e.g., 7 days), with participants engaging in goal-reflective behaviour. In this regard, diary studies have proved an effective method for investigating reflection-related phenomena (Ouweneel, Le Blanc, Schaufeli, & van Wijhe, 2012); the diary forms the intervention, allowing a combination of objective, validated measures with individually-tailored methodology. This intervention type has also been used frequently within the positive psychology literature (e.g., Amabile, Barsade, Mueller, & Staw, 2005, examined the relationship between positive affect and creativity).

Purpose of the Current Study

Primarily, we aimed to assess a novel goal-oriented intervention for increasing hope and subsequently, CF (see predictions below), via a brief, self-administered design located between single-session and sustained interventions. The intervention consisted of a daily diary task in which participants set *and* reflected on their goals. We used a convergent mixed methods design (Creswell & Plano Clark, 2018), with quantitative data (Phase 1) collected at two time points (i.e., before diary entries and after) to examine efficacy of the ‘self-conducted’ intervention (i.e., daily goal reflection). These data included hope, affect, and self-efficacy scores, alongside performance on a CF/fluency task (the Alternative Uses Task, see *Measures*). In Phase 2, qualitative data comprised entries from a daily open-ended goal reflection diary collected over one week, as well as general experiences of using the diary. To establish environmental and individual differences in hope, groups identified as having dispositional high levels of hope (e.g., spiritual/religious), or in environments found to respond well to hope interventions (e.g., office workers, students) were recruited (e.g., Ciarrocchi et al., 2008; Ouweneel et al., 2012). Overall, this enabled us to: 1) evaluate behaviour beyond the ‘typically-studied’ student population, 2) ensure sufficient diversity in age, educational background and occupation, and 3) maximize input from groups that have established relevance to the literature (e.g., dispositional or interventional relevance).

In terms of intervention impact on quantitative data, we expected an increase across all measures, including questionnaires, and the fluency task. In terms of qualitative data, we aimed to explore how participants engaged with their goals (i.e., how they reflect on them, whether goals elicit particular thoughts and/or affect etc). We also examined participants’ overall experience of the intervention, expecting participants to have a generally positive experience. Lastly, utilizing the benefits of mixed methods design, we investigated emergence of behavioural patterns, linking reflection activity (i.e., qualitative findings) and increases in

quantitative measures (e.g., increased hope, positive affect, CF, and/or reduced negative affect). In summary, we explored the data for evidence of a reciprocal, symbiotic-style association.

General Method

A mixed method design convergent approach was used collecting both qualitative and quantitative data concurrently (from the same sample) allowing increased understanding (Creswell & Plano Clark, 2018). For clarity, the methodology and results are presented in two phases, representing the qualitative and quantitative aspects of the study. However, their combination is used where appropriate to provide holistic perspective.

Participants

Forty-four participants (29 Female, 19 Male, $M_{age} = 36.9$ years, $SD = 14.4$) were recruited by opportunity sampling³⁹. Participants comprised three groups; Ordained, Office, Student. The Office and Student groups each had 15 participants, the Ordained group had 14. Forty (90%) of the participants self-reported English as their first language, two (5%) reporting Chinese, and one (2.5%) each for Turkish and Malay respectively. All members of the Ordained group were Christian. Further, six of the Office workers also identified as Christian. Three of the Student group were Christian and Muslim respectively, with one as Buddhist and Hindu. The Office and Students groups were recruited through University of Warwick Networks, Ordained participants via the Church of England Birmingham diocesan clergy bulletin. All participants completed both qualitative and quantitative phases of the study. The study was approved by the University of Warwick Psychology Department Ethics Committee. Participants received £30 upon finishing both phases of the study.

³⁹ Originally, 45 participants were recruited, however one participant withdrew, and their data was excluded.

Phase 1: Quantitative Data

Method

Measures

Questionnaires. A battery of six questionnaires was administered, divided into two sub-batteries: 1) Hope, 2) Affect and Efficacy⁴⁰. In the hope sub-battery, state hope was measured using the State Hope Scale (SHS; Snyder et al., 1996), which consists of six items, with ratings made on an eight-point Likert scale (1 = Definitely false; 8 = Definitely true). Trait hope was measured using the Trait Hope scale⁴¹ (THS; Snyder et al., 1991), with 12 items, and ratings made using an eight-point Likert Scale (1 = Definitely false; 8 = Definitely true).

In the Affect and Efficacy sub-battery, mood was measured using the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) which produces both a positive (PP) and negative (PN) score. This scale consists of 20 items, with responses made using five-point Likert scales (1 = Very slightly, 5 = Extremely). Self-efficacy was measured using the General Self-Efficacy Scale (GSE; Schwarzer & Jerusalem, 1995), which comprised ten items, each measured on a four-point Likert scale (1 = Not true at all, 4 = Exactly true).

Alternative Uses Task (AUT; Guilford et al., 1978)⁴². Participants are asked to generate up to six novel uses for each of a set of household items (e.g., a sewing needle), within a given time (4 minutes per section). The task is separated into four sections, each containing three different items. Five measures were taken from participants' responses: 1) Fluency

⁴⁰ General Religiosity Scale (Ritter & Preston, 2011) was administered to ensure that the religious emphasis placed on group differences was meaningful. As expected, Religiosity was higher for Ordained than both Student ($p < .001$) and Office ($p < .001$) groups (no differences between Office and Student groups; $p = .14$).

⁴¹ This is often referred to as the Adult Hope Scale, however, here, it has been labelled as the Trait Hope Scale to distinguish it from the State Hope measure.

⁴² Reproduction by special permission of the Publisher, Mind Garden, Inc., www.mindgarden.com from the Alternate Uses (Guilford's Alternate Uses) by J.P. Guilford, Paul R. Christensen, Philip R. Merrifield, & Robert C. Wilson. Copyright © 1960 by Sheridan Supply Co. Further Reproduction is prohibited without the Publisher's written consent.

(the total number of acceptable responses), 2) Flexibility (the number of categories acceptable uses related to), 3) Elaboration (how much participants elaborated on their answers), 4) Originality (how original the suggested use was compared to the rest of the sample), and 5) Accuracy (how many suggested uses were considered acceptable).

AUT Analysis. Initially, responses were coded by one researcher (see Guilford et al., 1978 handbook), however to ensure objectivity and consistency, the analysis was reviewed by a second coder (i.e., verify accepted/rejected responses). Responses were rejected if they met one of the following two conditions; first, if they were a repetition of a previous answer in the same part (e.g., A or B) by the same participant (e.g., ‘sewing needle’ and ‘fork’ might both be used as jewellery, but if the participant had just stated ‘jewellery’ or phrased the use in the same way for both, it would be rejected the second time). Second, responses were also rejected if the proposed use was infeasible, or did not make sense without further explanation. For example, an unacceptable response would be ‘lightbulb-start a fire’, however, ‘lightbulb- glass used to focus light and start a fire’ would be accepted.

Fluency was calculated as total acceptable responses for each section, with accuracy as total rejected responses. The *elaboration* score was determined based on the detail included in an acceptable response. Thus, ‘bedsheet-protect furniture’ would receive no elaboration points, whereas ‘bedsheet- protect furniture when painting’ would receive one point. *Flexibility* scores were obtained by summing the different use categories for each item. In this case, ‘shoe- used as a plant pot’, ‘shoe-used to squash bugs’, and ‘shoe- used as a weapon’ would receive two flexibility points; one for decoration, and one for weapon. Finally, *originality* was scored by comparing the frequency of accepted responses across the whole participant sample. For example, a use provided by fewer than 1% of the sample (in this instance, once) would accrue two points, and by fewer than 5% (twice), one point.

Procedure

Time One (T1): Before Diary Initiation. The researcher met with participants individually in a quiet, private space, or at the participant's home (see *Phase 2: Method*, for goal-diary procedure). Participants were provided with an information sheet detailing the expectations of the study, and informed consent and demographic details were collected. Part A of the AUT (Guilford et al., 1978) was administered. Participants were instructed that they would be presented with some common objects with a specified use (e.g., *newspaper; used for reading*), and that their task was to think of up to six alternative uses for each item.

Each participant was provided with the completed example for *newspaper* above and asked to note that each of the example uses differed from each other, and the primary use. Part A comprised two sections (six items and eight minutes total). All items in each section could be completed simultaneously, however, participants could not return to their responses once the four minutes were complete. Finally, the battery of six questionnaires was administered (see *Measures: Questionnaires*), without time limit. Each questionnaire included its own instructions, and the order of the questionnaires was randomly allocated prior to participation.

Time Two (T2): After Diary Completion. The researcher met with the participant again, in the same environment as time one, between one and two days after the final diary entry (approximately seven days after T1). Participants were administered part B of the AUT (Guilford et al., 1978), and an identical questionnaire battery as at time one. Finally, participants responded to two questions about their general experience of completing the diary (see *Phase 2: Methods* below). Participants were instructed to write as much as they wanted, without any time limit.

Results

Questionnaires

Table 61 shows questionnaire scores at T1 and T2. To test for the differences in questionnaire responses between T1 and T2, across the entire sample and between participant groups, a series of 2x3 (Questionnaire Time x Group) Mixed ANOVA's were conducted⁴³. The differences in scores between T1 and T2 for all questionnaire batteries are shown in Figure 51.

Battery 1: Hope. For SHS, responses at T2 were higher than at T1 for all groups, $F(1, 41) = 23.42, p = <.001, \eta^2 = .364$, with differences between Groups, $F(1, 41) = 3.82, p = .030, \eta^2 = .157$; no interaction was found ($p = .240$). Post-hoc pairwise comparisons revealed the Ordained group was higher in state hope than the Student group ($p = .009$), although no other differences were found (all $ps = > .159$). In comparison, while there was difference between Groups for THS, $F(1, 41) = 3.75, p = .032, \eta^2 = .155$, no main effect of Time ($p = .175$) and no interaction ($p = .733$) was found. Similarly, post-hoc pairwise comparisons showed the Ordained group to be higher in trait hope than the Student group ($p = .012$); no difference was found between the Office and Ordained groups ($p = .518$), and between Office and Student groups ($p = .052$). Interestingly, THS sub-scales suggested more nuanced effects. While no main effect of Time ($p = .632$), Group ($p = .179$) nor interaction ($p = .871$) was seen for the Pathways sub-scale, a striking contrast was seen with the other subscale. The Agency sub-scale demonstrated a main effect of Time, $F(1, 41) = 5.93, p = .019, \eta^2 = .126$, with scores higher at T2. No effect of Group ($p = .157$), nor an interaction ($p = .743$) achieved significance.

⁴³ Methodologically, a larger sample size would be ideal, however tension between the qualitative and quantitative phases limits participant numbers. Effect sizes are reported to substantiate results, and data from both phases are converged (see *Discussion* for more details).

Battery 2: Affect and Efficacy. Self-efficacy scores at T2 were higher than T1, $F(1, 41) = 7.37, p = .010, \eta^2 = .152$, although no interaction ($p = .736$) or Group differences were found ($p = .409$). For positivity (PP), differences were seen between Groups, $F(1, 41) = 4.71, p = .014, \eta^2 = .187$; post-hoc pairwise comparisons revealed both the Ordained and Office groups to be more positive than the Student group (p 's = .008 and .016 respectively), although the difference between Ordained and Office groups was not ($p = .770$); no main effect of Time ($p = .377$), or interaction was found ($p = .164$). For negativity (PN), participants were found to be less negative at T2 compared to T1, $F(1, 41) = 16.54, p < .001, \eta^2 = .287$; no interaction ($p = .359$), or Group main effect was found ($p = .229$). As a main effect of Time was only found for negativity, a paired sample t-test was calculated post-hoc to explore the difference in affect change (PN change mean = -3.75, PP change mean = 0.73), $t(44) = 3.19, p = .003$, with a medium effect size, $d = 0.75^{44}$, revealing the reduction in negativity between T1 and T2 to be independent from the absence of changes to positivity.

AUT

To test for the differences in AUT performance between T1 and T2, both overall and between participant groups, a series of 2x3 Mixed ANOVA's (AUT Time x Group) were conducted, see Table 62 for AUT scores. The differences between T1 and T2 for all AUT outcome measures are shown in Figure 52.

At T2, Fluency scores were found to be higher than T1 across all groups, $F(1, 41) = 82.24, P < .001, \eta^2 = .667$. No interaction ($p = .834$), or Group differences was found ($p = .090$). Across all groups, Flexibility at T2 was found to be higher than T1, $F(1, 41) = 110.23, P < .001, \eta^2 = .729$, although no interaction ($p = .656$), or Group differences were found ($p =$

⁴⁴ Cohen's d was used to evaluate effect size

.059). A main effect for Time was found for Elaboration, $F(1, 41) = 9.99$, $P = .003$, $\eta^2 = .196$; no interaction ($p = .493$), or Group differences were found ($p = .152$). Similarly, all groups were found to make fewer mistakes at T2 compared to T1, $F(1, 41) = 45.85$, $P < .001$, $\eta^2 = .528$, although no interaction ($p = .109$), or group differences were found ($p = .478$). Finally, for Originality no main effect was found for Time ($p = .319$), Group ($p = .443$), or interaction ($p = .418$).

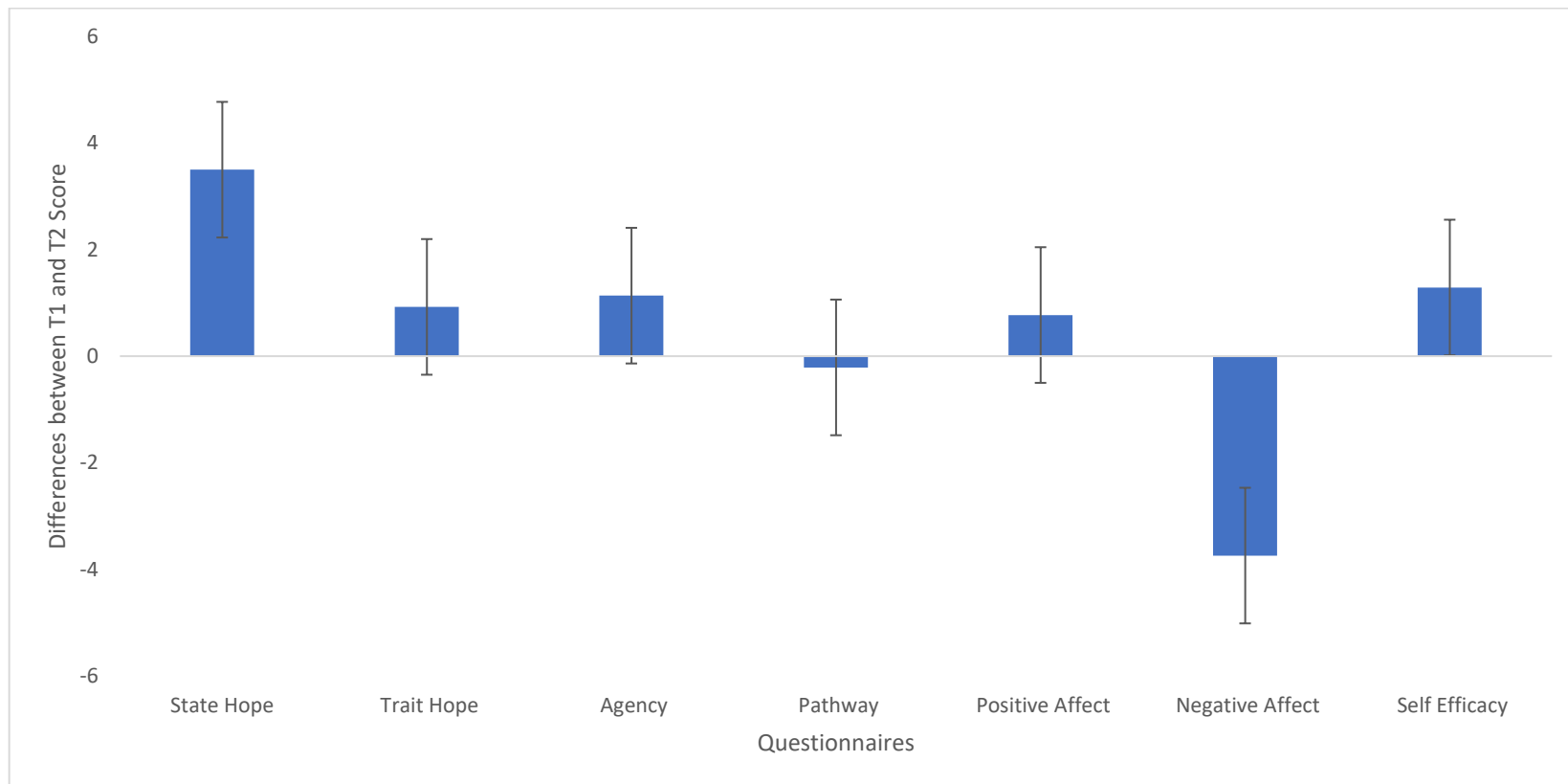


Figure 51. Differences in questionnaire scores between T1 and T2. Error bars indicate ± 1 standard error of the mean.

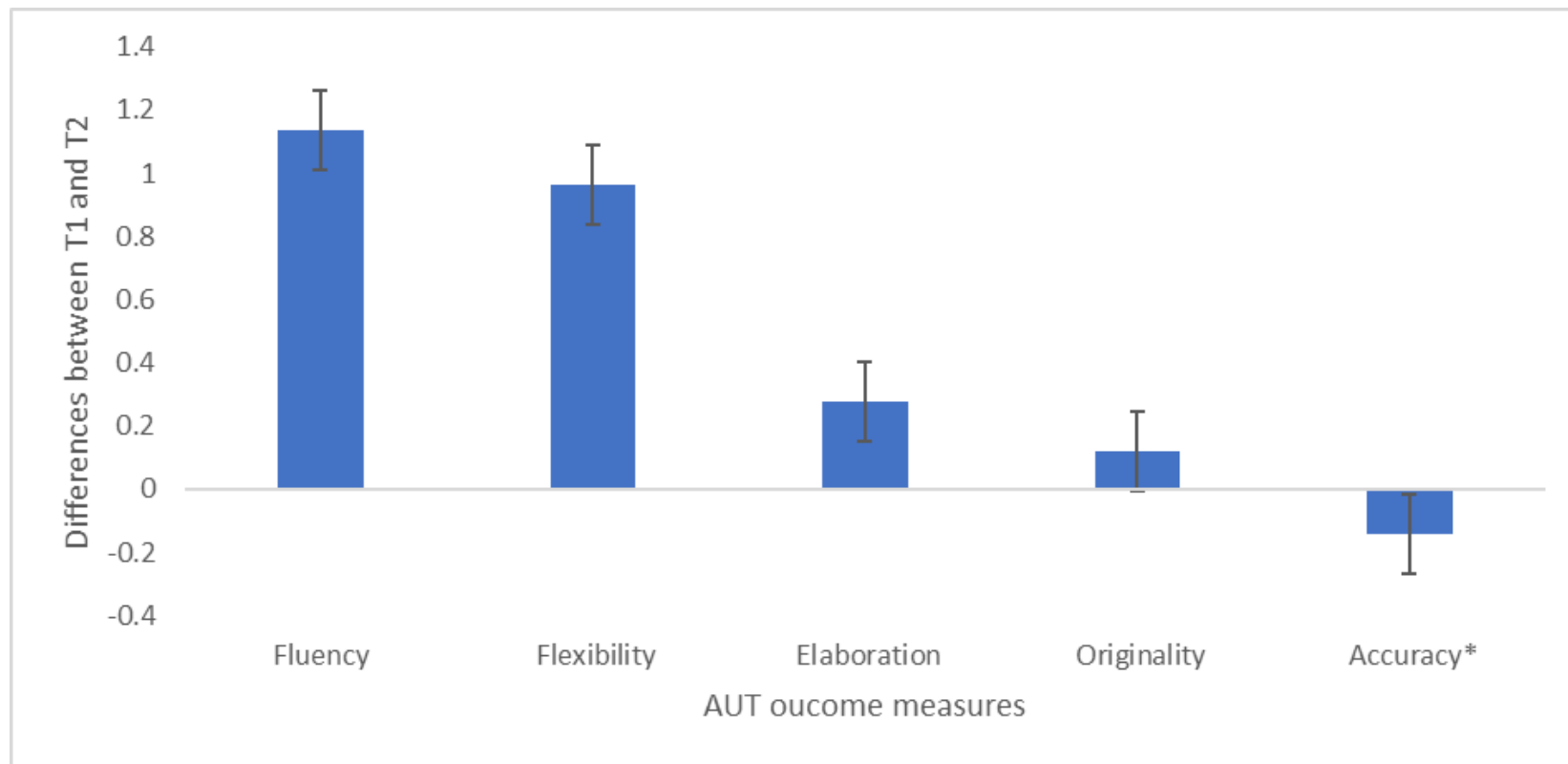


Figure 52. Differences in AUT outcome scores between T1 and T2. Error bars indicate ± 1 standard error of the mean. *Typically in the text, Accuracy has been presented as a percentage, however for consistency in Figure 2, this value reflects the absolute score difference.

Table 61. Mean questionnaire scores (Standard Deviations in parenthesis) both T1 and T2, by group

Group	SHS		THS		Agency		Pathways		PP		PN		GSE	
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
Ordained	37.14 (6.38)	40.50 (5.75)	46.14 (3.55)	46.71 (4.39)	25.36 (3.25)	26.43 (4.16)	20.79 (3.56)	20.29 (3.97)	37.36 (7.98)	40.07 (7.60)	25.50 (1.29)	12.14 (2.85)	32.07 (4.53)	33.00 (4.11)
Office	34.73 (5.13)	36.80 (3.78)	45.13 (3.31)	45.67 (3.64)	24.27 (2.84)	25.00 (2.93)	20.87 (3.18)	20.67 (2.66)	37.47 (6.80)	38.47 (4.12)	9.80 (5.02)	12.07 (2.60)	30.13 (3.68)	31.93 (3.75)
Student	30.40 (7.62)	35.47 (7.68)	41.47 (5.42)	43.13 (7.16)	22.53 (4.37)	24.13 (4.90)	18.93 (2.52)	19.00 (3.00)	32.40 (7.03)	31.00 (9.76)	12.60 (6.95)	16.07 (6.31)	30.07 (4.62)	31.20 (4.81)
Overall	34.02	37.52	44.20	45.14	24.02	25.16	20.18	19.98	35.70	36.43	15.75	13.45	30.73	32.02
Mean	(6.91)	(6.20)	(4.59)	(5.40)	(3.66)	(4.09)	(3.16)	(3.25)	(7.49)	(8.37)	(8.44)	(4.61)	(4.29)	(4.22)

Note: N= 44; n= 15 Office and Student groups, n=14 Ordained group. State Hope Scale (SHS), Trait Hope Scale (THS; Agency and Pathway subscales), PANAS Positive subscale (PP), PANAS Negative subscale (PN), General Self Efficacy (GSE).

Table 62. Mean AUT scores (Standard Deviation in parenthesis) across T1 and T2, by dependent variable and group

Group	Fluency		Flexibility		Elaboration		Originality		Accuracy	
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
Ordained	2.32 (1.07)	3.56 (1.20)	1.75 (0.73)	2.77 (0.96)	0.88 (0.99)	1.30 (1.08)	1.04 (1.06)	1.17 (1.17)	70.93% (22.63)	90.83% (10.41)
Office	2.64 (0.68)	3.76 (0.87)	1.84 (0.43)	2.87 (0.67)	0.74 (0.42)	1.01 (0.78)	0.96 (0.74)	0.88 (0.93)	79.52% (14.38)	88.43% (8.37)
Student	1.91 (0.80)	2.97 (1.37)	1.40 (0.41)	2.24 (0.86)	0.51 (0.48)	0.67 (0.48)	0.57 (0.64)	0.88 (0.69)	72.11% (12.51)	85.39% (8.46)
Overall mean	2.29 (0.90)	3.42 (1.19)	1.66 (0.56)	2.63 (0.86)	0.71 (0.67)	0.98 (0.83)	0.85 (0.83)	0.97 (0.93)	74.26% (16.97)	88.16% (9.16)

Phase 1 Discussion

Overall, participants' scores increased between T1 and T2, indicating an effective intervention. Improvement in THS agency scores was notable, particularly when compared to trait hope overall, and pathways scores (which did not increase). For affect specifically (i.e., PANAS scores), an elevation was indicated overall, but this occurred via a decrease in negative affect scores; positive scores per se did not increase. Echoing questionnaire data, scores on AUT measures (cf. Originality scores) increased between T1 and T2. However, no Group x Time interactions were seen for questionnaire or AUT scores.

Although a general improvement in scores was predicted across all measures, in terms of hope, the distinction between state and trait measure effects (and thereafter, between pathways and agency effects) suggests separate mechanisms may underlie these processes. In particular, the improved agency score aligned more with measures such as self-efficacy and state hope (consistent with previous literature; see Aspinwall & Leaf, 2002), indicating an overall shift in goal-orientation. Furthermore, the divergence between trait subscales reinforces a debate on the conceptualisation of hope (i.e., interconnectedness of agency and pathway; see Tong et al, 2010), suggesting a potential for more concrete, focused goals to enable pathway thinking. On a simplistic level, this is consistent with the nature of undertaking the diary task; participants reflected on goals, their attainment and implications. Indeed, it is possible that GSE (i.e., improved perception of personal competence; Scholz, Gutiérrez Doña, Sud, & Schwarzer, 2002) increases along with agency, indicating that the intervention encourages participants towards more self-concordant thinking and internal motivation. In turn, this highlights differences between the facets of trait hope (see *Phase 2* for further discussion in light of qualitative findings).

Examining these results in the light of BBH, tentative evidence of the 'undoing effect' emerges (e.g., countering negative effects; Fredrickson, 2001). As PANAS scores are: 1) not a reciprocal measure (i.e., positivity did not increase

because negativity decreased), nor 2) behaviourally linked as constructs (i.e., validation data has confirmed independence of negative and positive affect in the scales; see Watson et al., 1988), completing the diary task may have contributed to ‘undoing’ negative affect experienced by participants (e.g., due to prior affective state or concurrent life experiences etc.). However, the lack of increase in positivity is perplexing, particularly as positivity (and optimism more broadly), have been connected with hope previously (see e.g., Gasper, Spencer, & Middlewood, 2019; Kelberer, Kraines, & Wells, 2018).

That said, the posited undoing effect indicates the impact of the intervention may be more restorative than preventative. Rather than boosting positivity to secure protection against future negativity, the intervention may restore affective equilibrium. This appears consistent with the wide-range of improved ‘coping’ effects associated with increased hope (e.g., athletic performance, stress, physical health; Berg et al., 2008; Curry et al., 1997; Nothwehr et al., 2013). Individual differences in the subjective experiences of participants may give further insight into these unexpected results (see *Phase 2* below).

Data from the AUT suggest improved CF in a number of domains; specifically, precision of response, elaboration and overall number of responses over time, while acknowledging possible training effects, given the short time span. This is particularly important to both the CF and BBH literatures, as it demonstrates CF in a naturalistic, applied setting (cf. previously used questionnaire measures; e.g., Dennis & Vander Wal, 2010), and consolidates previous findings (e.g., Muyan-Yilik & Demir, 2019). Additionally, it is possible to argue that CF, as a collection of higher cognitive functions (or an overarching ability that ‘marshals’ lower cognition), is affected by positivity in a similar way to low-level functions (e.g., memory and attention; Gasper & Clore, 2002).

Phase 2: Qualitative data

Method

Materials

Goal Diary. The diary was divided into four sections, and consisted of seven prompts, each with a free-response answer (see Table 63 below). The diary was in digital format as a secure online form, or a word-processing document (if internet access was limited). The diary was completed each evening, between 6pm and midnight, and was estimated to take 15 minutes to complete. In section 1, participants were asked to think about the goals set for that day. Section 2 required participants to set goals for the next day. Finally, section 3 was an open section to be utilised by participants to write about whatever they wanted.

Table 63. Prompts and questions to be answered in each daily diary entry

Q1	<i>Please briefly recap the goals that you had set for yourself today, and if you achieved them?</i>
Q2	<i>Thinking about these goals, describe any plan that you might have used, or any obstacles or problems occur that you had to overcome</i>
Q3	<i>Please reflect on and describe how it feels now to think on what you achieved today</i>
Q4	<i>If you did not reach all of your goals, think about and detail what you could have done to change the outcome. If you did achieve everything, would you do anything differently?</i>
Q5	<i>Please detail the goal, or goals you want to achieve tomorrow</i>
Q6	<i>Why do you want to achieve these goals, and what will it mean to achieve them?</i>
Q7	<i>This is an open section for you to share any thoughts or feelings from today. They can relate to the goals you have listed, or anything else that you think may be relevant or that you just want to record</i>

End of Diary Questions. At the end of the study (i.e., T2), each participant was given two prompts, designed to elicit a response of their overall experience after completing the diary. First, participants were asked to write about their *'General ideas, thoughts and experience'*, and secondly, to consider the following questions, *'Do you think completing the goal diary has had any lasting effects? Have any aspects of your behaviour changed?'*. Each question was free-response, with no limits on word length or time taken.

Procedure

Participants received instruction on completing the diary at the end of T1 (see *Phase 1: Procedure* above). An example version of the diary was provided, and the researcher described each section to the participant, explaining each question in detail and responding to queries. Participants were instructed that these goals should be personally relevant. That is, goals did not need to be 'life-changing' and could vary in both significance and number "*so long as they mean something to you*". The requirement to reflect on goals set on the following day was also outlined at this point. Finally, participants were reminded that all seven entries should be completed, but that the style of diary interaction within this framework was entirely their choice (e.g., number of goals, personal relevance of goals, description style). Participants were sent a digital copy of the diary immediately after completion of T1, and the same template was used each day.

Participants were assigned an ID code to input with each entry. They were instructed that the diary would take around 15 minutes each day to complete, between 6 pm midnight (if possible, at the same time each evening). A reminder email was sent each day at 6pm. Participants were provided with contact details for the researcher to ask any questions throughout the week of the diary. Participants completed all sections on all days, with the exception of part one on day one (as no goals had previously been set). Day one of the diary started within a day of T1 completion.

Data Analysis

All diary data were prepared for analysis by combining entries, and anonymising any identifying information; data were then entered into an NVivo (QSR International Pty Ltd, 2015) database. Thematic Analysis (TA) was used to explore the diaries (Braun & Clarke, 2006); specifically, this is an inductive, essentialist TA, extracting semantic themes that describe meaning as reported by participants, rather than situating responses within wider context or pre-established theories. For themes to be classified, codes must occur across the whole data set and represent prevalent ideas or experiences. The PI was working from a positive psychology perspective and the research and subsequent analysis was conducted as part of their PhD. In order to combat any bias, analysis was reviewed by the final author to ensure themes were a credible representation of codes (i.e., checking initial coding and emergent themes for validity); where discrepancies arose, the initial codes were reviewed until an agreement was reached.

Results

The most frequent goals were social (e.g., spending time with friends or family), followed by work- or academic-related goals. Distribution of goal type within each group appeared approximately equivalent, beyond those intuitively connected with specific groups (e.g., worship would be expected to be higher for the Ordained group than other groups). The research questions of goal reflection and subjective experience of the intervention were analysed separately using TA and are presented below, followed by a discussion of the Phase 2 findings.

How Do Participants Reflect on Their Goals?

Two overarching themes were identified from the data: Positivity and Negativity, each with corresponding sub-themes.

Positivity. Broadly, the *Positivity* theme recognised participants' experience of reflection on daily goals to be beneficial. The idea that reflection

invoked a positive feeling or emotion was strongly evident, albeit often reported in a succinct way:

"It feels good to have achieved these goals" (Ordained, Male, age 35).

This positivity theme was present across all diaries, with approximately consistent representation each day of the diary, and across groups. Four sub-themes were also identified: *Relief*, *Completeness*, *Unexpected Bonus*, and *Positive Self*.

In the first sub-theme of *Relief*, people described the achievement of goals as being coupled with release of pressure, often using words that invoked a physical release:

"It had helped my head feel clearer too without all the clutter that often feels 'on top' of me" (Ordained, Female, age 51).

Another distinct sub-theme, was *Completeness*, where participants described achievement of their goals as finalised, or having finished everything they planned:

"It's always pleasing to get all the jobs done" (Student, Male, age 35).

Interestingly, items here also described extensive, time-demanding goals which might have taken a long time to complete, or that the individual had avoided, thereby achieving a sense of completion after delay or procrastination:

"LinkedIn has been on my to do list for a long time so I got up early to do it today and feel happy to have achieved this" (Office, Female, age 44).

A third sub-theme *Unexpected Bonus*, identified semi-meta analytical reflections on how positive the actual diary was, and how in turn, the diary task impacted on the way they thought about their goals, and resulting satisfaction:

"I recognise that setting myself these goals make me actively pursue them. I have previously written about not feeling the need to set goals for

work because I manage my workload...Clearly, I need to adopt the same process when it comes to achieving my overall goal for myself to feel healthier and focus on myself some more” (Office, Female, aged 32).

In addition, via daily reflection, participants were able to recognise that they had achieved more than they planned:

“It feels great to have not only accomplished your tasks but to also have ‘put out fires’ for other people” (Ordained, Male, age 32).

These reflections often enabled people to take account of everything they completed that day, *and* how such ‘bonus goals’ added to a sense of achievement; note, *Unexpected Bonus* was mostly (but not exclusively) comprised from the Ordained participants:

“It feels like an especially productive day. It is really satisfying to end the day knowing not only that planned goals were met, but lots of additional things accomplished too” (Office, Female, age 41).

Finally, the last sub-theme was *Positive Self*; specifically, the idea that the reflection process allowed participants to recognise their own strengths and capabilities:

“Many of my achievements are focused on my values - empowering others, reducing stress in others, enabling self-awareness. So when I achieve these things I feel happy” (Office, Male, age 49).

In addition, the idea of pride was often cited here, with participants recognising their goal achievement(s):

“I feel proud that I finally achieved my goals” (Student, Female, age 22).

Negativity. While far less common than the *Positivity* themes above, an overarching *Negativity* theme was also identified, along with three sub-themes: *Dissatisfaction*, *Negative Self Reflection*, and *Guilt*. The first, and most substantial sub-theme was that of *Dissatisfaction*, and the notion of being upset at what was

(or was not) achieved that day. Participants described or reflected disappointingly on the balance of what they did achieve:

"I'm disappointed because I don't think I achieved enough" (Student, Female, age 18).

Although this theme was represented in all groups, dissatisfaction was most commonly identified in the Student group. Further, this sub-theme was most common on the first day of the diary and tended to decrease over time.

A less frequent, but noteworthy sub-theme was that of *Negative Self Reflection*. People who reflected in this way considered reasons behind personal blame for not achieving their goals, expressing ideas such as disappointment:

“:([SIC] I am irritated about this because it is something I really want to achieve and have done for a while, but when it comes to it, I prioritise everything else” (Office, Female, age 27).

This also extended to ideas of an individual not being good enough as the reason for not meeting their goal:

“what I have done is never good enough” (Office, Female, age 23).

Finally, *Guilt* (almost exclusively represented in the Student group) was also a common construct identified by participants, with guilty feelings being expressed in respect of failure to achieve what they planned:

“Feeling guilty for not completing my tasks, hoping to try to complete them tomorrow” (Student, Female, age 29).

Notably these ideas of guilt were sometimes accompanied with an attempt to nullify the feeling, or motivate a change in behaviour:

“I'm actually sitting here contemplating whether to go out for a walk now in an effort to feel less guilty” (Office, Female, age 52).

Changes Throughout the Week and Moving Forwards

From the responses to the free-response question at T2 (*'Do you think completing the goal diary has had any lasting effects? Have any aspects of your behaviour changed?'*) two overarching themes were identified: Diary issues, and Benefits of reflection, with corresponding sub-themes

Diary Issues. Comprised of two sub-themes (*Mundane Goals* and *Inexperience*) a small sample in each group (most frequent in the Office group), reflected on finding the diary itself difficult to manage. Specifically, participants suggested that the diary became a '*chore*' as the week progressed, but also acknowledged that their engagement with the diary may have been lacking:

"I started to feel that doing the goals and diary became a chore in itself. In hindsight the goals were probably more tasks" (Office, Female, age 55).

This emphasizes the highly subjective experience of the diary task, as well as the importance of both motivation and volition. This is further evidenced by the sub-theme of *Mundane Goals*; here, participants self-described their goals set as ordinary or simple. Not engaging in the reflective elements of the diary (due to a perceived problem with the goals) appears to constrain participant experience:

"I have found that the goals I set myself were not always the most significant things on paper about my day, but they were the things that would likely get overlooked, for example having a rest" (Ordained, Female, age 34).

Further, a related sub-theme of *Inexperience* highlighted this issue with engagement, with participants struggling with goal-setting due to unfamiliarity with the concept:

"It was a new experience for me having to set goals for the next day as I am more of a spontaneous person, and my plans change all the time" (Student, Female, age 29).

Benefits of Reflection. Formed of three sub-themes (*Continued Behaviour*, *Goal Understanding*, and *Dedicated Time*), participants postulated positive aspects of the intervention. An especially prevalent sub-theme identified was *Continued Behaviour*, with participants from all groups discussing the merits of continuing with their established practices:

“Overall this has been a positive experience and one which I can see would be useful and beneficial for me to continue” (Ordained, Female, age 51).

A second sub-theme (*Goal Understanding*) identified the benefits of the diary structure, and how the procedure allowed participants to be more aware of their goal directed behaviour:

“I looked forward to the time to reflect on the day. The goal setting worked for me. The process of writing down the goals - almost felt like a contract with myself which I would commit to. This fed my drive to keep at it. The goals were not huge but together overtime will have an impact on my sense of well being” (Office, Female, age 52).

The final sub-theme identified was *Dedicated Time*; people found they were able to recognise the benefits of having some time set aside each day:

“Having that time to reflect has made me think about not just the day but the whole situation I am currently in... it has been a really useful half an hour each day to sit and quietly reflect and something that I will hope to do moving forward” (Student, Male, age 35).

By allowing some time to think and process their day, it could be suggested that participants were able to process their goals in a more meaningful way. In particular, an idea emerged that by considering the day holistically (i.e., not separating work, personal, social goal and chores), people were able to recognise how each thing they achieved contributed to their day, indicating a general increase in willpower or agency related thinking:

"I think that completing the diary has helped me to begin to think more carefully about how I am using my time each day, and to what extent certain tasks ought to take up my time. I have noticed that I tended to set very few 'personal' goals... This has made me start to ask myself when and how I might re-balance this aspect of my life" (Ordained, Male, age 49).

Finally, as part of *Dedicated Time*, it was also identified that this enabled participants to reflect more broadly on their goals and specifically, the way they engage with them:

"I have found the diary helpful as a tool for reflection and for revisiting this aspect of my daily life. It has been positive and supportive. I feel it has given me the opportunity to reconsider some ways I work and live" (Ordained, Male, age 59).

Commonality between the *Benefits of Reflection* sub-themes suggests that people found reflective time to be beneficial to their lives, instilling a sense of motivation and productivity that allows them to reach their goal(s).

Discussion: Phase 2

Echoing Phase 1, a shift towards more self-concordant, internally-motivated thinking was demonstrated by participants, providing converging support for the effectiveness of the intervention. Overall, participants found undertaking the diary task a positive experience, with many expressing an intention to continue goal-setting/reflection practice. However, this positive experience was not universal, with a small number of participants citing restrictions or repetitious design to be an issue.

The richness of the qualitative data allows for a more nuanced understanding of the behaviour on display, and extends the findings of Phase 1. For example, we can argue that the subjective importance of participants' goals (e.g., daily chores and obligations) as a means to evaluate 'success' emerged, regardless of objective goal magnitude/relevance. In fact, participants appeared

to view goal attainment more holistically, recognising positive impact on wellbeing (e.g., spending more time focused on things important to them). Similarly, a level of critical reflection was also evident, promoting meaningful, self-concordant goal- setting in participants and reducing mechanistic checking items off a 'to-do' list. However, those for whom the diary task was not positive still represented an important voice. Notably, a consistent interpretation of this group focused on obligation, as well as the lack of freedom and spontaneity in respect of the task, despite the lack of concrete constraints. That said, more negative responses (e.g., guilt) still motivated a change in behaviour (or at least, thought), suggesting increased goal awareness, and goal-oriented behaviour, regardless of subjective experience.

General Discussion

We can affirm quantitative and qualitative support for a successful intervention. Our findings are consistent with previous work on positivity interventions (e.g., Cheavens et al, 2006). Participants demonstrated increased levels of state hope and trait hope agency, decreased negativity, and enhanced CF. Subjectively, most participants found the study to be a positive experience, and subsequently, demonstrated a substantial shift in goal-oriented thinking. Evidence from both study phases converged strongly (see *Converging Quantitative and Qualitative Data* below), giving further insight into efficacy of the intervention. However, interesting divergence was also noted. For example, no increase in positive affect was seen in Phase 1, despite robust subjective experience of task 'positivity' in Phase 2. The contrast between objective measures and subjective experience underlines how the same phenomenon (i.e., positivity) can be expressed. Overall, this highlights the nuanced findings characteristic of (and arguably, only attainable via) a mixed methods approach.

Converging Quantitative and Qualitative Data

The use of a convergent mixed methods design (Creswell & Plano Clark, 2018) is a distinct strength of this study. For example, diary entries may account

for differences between agency and pathway changes whereas the quantitative data alone would suggest the intervention did not access the depth of reflection typically required for pathway-related hope. Conversely, Phase 2 data highlighted increased engagement (e.g., more comprehensive responses) to agency-centred questions, indicating a focus on agency (i.e. rather than absence of pathway orientation). Intuitively, pathways thinking is more aligned to practical aspects of goal attainment (e.g., problem-solving, obstacle avoidance), thus, the *reflective* goal-oriented task may elicit more abstract, agency-based constructs (e.g., willpower, self-concordance). Moreover, gaining insight into changes of affect also evidences convergence. The ‘undoing effect’ (i.e., reduction in negativity; Fredrickson, 2001) suggested by Phase 1 is ostensibly different in nature to positive task experience observed in Phase 2. Overall, subjective experience of this affect change is interpreted by participants as positive, but is manifested behaviourally by a reduction in negativity.

In addition, these convergent data are useful as confirmatory measures where objective evidence is unavailable; for example, regarding absence of Time x Group interactions (see *Phase 1: Results*). That is, insight into participants’ experience of the intervention (i.e., seen via qualitative data) allows fuller interpretation of the quantitative data. Clearly, goals were individual to participants, but shifts in goal-oriented thinking were identifiable across all groups. Instead, it could be suggested that the act of reflection (i.e., evaluating goals and their significance) has similar impact on all participants, regardless of pre-intervention individual differences. Overall, these conclusions represent a holistic view of participant behaviour and experience, mainly due to the methodological approach adopted.

Study Implications and Future Directions

Evidence showed the current intervention to be both robust and effective, with increases in CF, state hope, agency, and reduced negativity, as well as positive subjective experience of the task. Although this converges with previous literature (e.g., see Weis and Speridakos, 2011), that is not to say

improvements could not be made. A pertinent future avenue of research could consider the implication of age. Age and hope have been examined previously, with some debate about their relationship (i.e., limited evidence for negative correlation; see Gum, 2017, for a discussion). However, age was not controlled here, as participants were recruited based on their occupation (e.g., HE students, office workers, ordained clergy), with differences in mean age seen as a consequence of group membership. Moreover, we did not anticipate particular age-related differences, as participants have responded positively to hope-based interventions across the lifespan (e.g., Marques et al., 2011).

However, age differences in related phenomena have been found in other studies (e.g., optimism; You, Fung, & Isaacowitz, 2009) and we observed small qualitative differences in behaviour that were potentially reflective of age. Older participants tended to have family- or children-centred goals, whereas a focus on friendship typified student responses, and we might still question if the content of the goal is important, or simply having a goal is sufficient to influence behaviour. Future research might consider controlling for age across participant groups or exploring its relationship (or interaction) with this intervention.

Future work could also develop the intervention, focusing more closely on trait hope. While shorter interventions have been found to be more effective (Weis & Speridakos, 2011), hence our methodological choices, an extended duration might yield more insight. This is indicated particularly by current participants' desire to continue reflective practices involved in the diary task. Agency and pathways aspects of hope are considered iterative and additive (i.e., increase in agency leads to increase in pathways, and vice versa; Snyder et al., 1991), and while this claim is contentious (e.g., Tong et al., 2011) more time may have been needed for an increase in pathways to emerge. However, the observations (i.e., absence of pathway and positivity changes) may be reflective of a wider population's response to the intervention; thus, controlling for these via methodological changes may constrain the richness of the data that has proved valuable in this instance. Finally, analysis focused on connecting the two data phases more clearly (e.g., Triangulation Design) may yield more insight into

the interplay between subjective experience and outcome measures. Moreover, qualitative analysis focused specifically on goal type or motivation may allow for an understanding of the impact goal *content* has on behavioural outcomes, or indeed, hope.

Conclusions

This study showed reliable increases in state hope and trait agency across three groups of participants (HE students, office workers, ordained clergy) with use of a novel goal-oriented intervention. Further, using a more naturalistic test of CF (i.e., the AUT; cf questionnaires/deficit measures) appeared to facilitate nuanced understanding of behaviour, especially in the case of CF enhancement. Finally, application of a mixed methods approach elicited both objective and subjective support for the intervention, in addition to a convergence of findings that would not be possible with a single methodological approach.

Supplementary Analysis

As stated above, given the useful exploration of goal-setting practice (i.e., specific goals and motivation), an inductive conventional content analysis (CA; Hsieh & Shannon, 2005) was conducted. Although this could not be included in the original publication (both due to the focused narrative presented, and the length of the article), this CA allowed a ‘first step’ into examining goals more closely. The intention of its inclusion here is not to provide comprehensive review of goal-typology and/or motivation, but instead to capitalise on the rich data collected as part of the study. The results are presented below, and their interpretation (both within the context of this study specifically, and the wider thesis) are discussed in *Supplementary Discussion*.

Goals

The results of the CA are presented in Table 64 below; examples for any sub-categories are presented textually. Several relatively predictable categories were identified, given sample populations (e.g., *Academic* goals were mostly set

by students). *Work* emerged across all three groups, and related mainly to daily work-based activities, with a smaller sub-category of *Avoiding Work* (i.e., goals specifically focused on not engaging in work-related activities, e.g., *“I want to try to forget work and everything going on there once I finish for the day”*). The most common category was *Social*, which centred on friends and family. A small sub-category of *Social Support* was also identified, which was most typically associated with Ordained participants (e.g., *“be available afterwards for the family and friends who will be attending for emotional/spiritual support and give every assurance of the life to come and our place with the deceased in the Heavenly Kingdom”*).

Table 64. Categories of goals identified, with overall frequency and example

Goal category	Example
Social	<i>“Spend some quality time with family”</i>
Work	<i>“Provision new laptops and give to staff members”</i>
Logistics and Preparation	<i>“draw up a schedule for other fitness classes I want to enrol on and then book them”</i>
Academic	<i>“Attend all my lectures and seminars, finish up one of my end-of-term assignments”</i>
Worship	<i>“To preach and lead to the best of my ability on the day, allowing God to speak through me”</i>
Chores	<i>“I want to do the weekly shop and keep in budget”</i>
Health and Exercise	<i>“I want to do 10,000 steps”</i>
Rest and Relaxation	<i>“A coffee shop visit as it's my day off”</i>
Self-Reflection	<i>“Be more grateful for what I have”</i>

Overall, small, but important differences within categories emerged in relation to each group. For example, all groups had goals dedicated to social

activities; however, these tended to be focused more on family for the Ordained and Office groups (e.g., *"I am looking after both of my sons as my wife is busy all day. Therefore my goal is to survive the day and keep my boys happy"*), and friends for the Student group (e.g., *"hang with friends"*).

Motivation

The diary format of this study has resulted in participant responses ranging from specific motivations for each goal set, through to a general answer which discussed their motivations more broadly. Pre-existing theories and research (e.g., Seo, Patall, Henderson, & Steingut, 2018; Werner, Milyavskaya, Foxen-Craft, & Koestner, 2016) have discussed motivation at length (i.e., the differences between internal/external motivation, self-concordant goals, goals motivated via necessity or obligation), therefore using a deductive approach to 'fit' motivations into these pre-existing categories was considered too parsimonious in this instance.

A number of the categories identified were foreseeable, insofar as they were specific to a particular group; for example, the category of *God and Vocation* was mostly populated by Ordained participants. This focused on motivation for the goal being connected to a relationship with God. The *Other People* category centred on wanting to achieve a goal because of relationship with someone else. While this category was identified in all groups, it was most frequent in the Ordained group.

Further, the category *Just Because* was particularly transparent; some goals just 'needed to be achieved'. The *Deadline* category was also straightforward according to this evaluative, and comprised motivations around goal completion due to external time pressure. However, an interesting sub-category of *Deadline* was *Previously Avoided* (mostly populated from the Student group). Here, the deadline only emerged because a goal had been avoided previously (e.g., *"The other is something I don't like doing so will hopefully this will give me extra incentive to get it done"*).

The *Present-Self* category refers to times where participants were broadly motivated by themselves, with a focus on self-care, ranging from broadly positive ideation through to more direct self-preservation (e.g., *"I just need some time for me"*). The *Proactive* category consisted of motivations aimed at solving future problems or avoiding obstacles. Although similar to *Present-Self* category, here, the focus of participants was to attend to a goal which did not necessarily need to be completed, but did provide a future advantage. Two distinct sub-categories emerged from this category. Firstly, we saw *Creating Time*, which covered participants being motivated by freeing up time at a future date (and dedicated to more desirable pursuits; e.g., *"One will mean I don't need to worry about it on Saturday, which will really help me then"*). Secondly, the sub-category *Creating Opportunity* emerged, which encompassed motivations which would *only* benefit the individual in the future (e.g., *"it is very important that I start looking for grad schemes to prepare for the end of year, especially as I do not know what I want to do afterwards"*). Notably, the majority of the *Create Opportunity* sub-category items were from the Student group.

The *Responsibility* category was populated by motivations of goal-achievement related solely to expectations. Within this, a sub-category of *Role Fulfilment* was identified, which described an idea of achieving a goal because of importance to a participant's job or vocation (e.g., *"Meeting families seeking baptism is a privilege, a mandatory requirement and an opportunity to serve as well as to listen to their faith stories"*). *Role Fulfilment* was identified in all groups, although Ordained participants more frequently cited this as a motivating factor.

Table 65. Categories of Motivation identified, with overall frequency and examples

Goal category	Example
Present self	<i>"It will mean I can rest properly, attend to my own needs"</i>
Proactive	<i>"To get 'ahead of the game' freeing up some time and space on Saturday which often feels overly full of work and pressured. This will leave more time to spend with the family on Saturday"</i>
Other people	<i>"My sister has been really helpful looking after our little one this weekend, so I'd really like to treat her"</i>
Responsibility	<i>"It's an important part of the role - the hospitality and welcome and standard offered"</i>
Deadline	<i>"For some of the goals they are strictly tasks that need to be done and I've been putting off"</i>
Just because	<i>"Quite a few of them simply have to be done"</i>
God and Vocation	<i>"Daily devotions is part of my rule of life which grounds and balances me. First reading of the scriptures for next sermon is exciting and energises me"</i>

During the analysis, a general pattern was noted across all groups. Participants tended to start the diary motivated by other people, deadlines, and being proactive (the most populated three categories respectively). However, this contrasted to entries at the end of the week where the motivation was driven more from the self, being proactive, and other people respectively. Being proactive remains consistent throughout the week, but the divergence from external, pressured motivations to ones driven by self-care and a sense of agency is important in terms of self-concordant thinking.

Supplementary Discussion

Considering the categories identified across both CAs above, two initial conclusions can immediately be drawn. First, for the most part, goals and

motivations are in line with what we might intuitively expect. Both goals and motivations reflect individual circumstances and environments (e.g., the differences in *Social* goals between typically older and younger groups) yet show commonality across groups (i.e., the goals are social regardless of context). Second, self-concordance appears to increase with goal reflection as the week progresses and both goals and motivations for attainment become less focused on fulfilling external pressures or perceived compulsions. This is in line with previous literature (i.e., Koestner et al, 2002), where increased self-concordance of goals is connected with improved goal implementation and attainment. Simply put, people set goals that are more important to them, and thus, gain more from their achievement. In turn, this process self-perpetuates, as individuals then set additional important goals etc.

The conclusions from these CA should be treated tentatively as clearly, further work is needed (see *Chapter 9: General Discussion*). That said, an interesting pattern can be inferred if we converge all data from this study to gain a more holistic perspective. As state hope, trait agency, and CF increase (and negativity decreases), goal (and motivations) become more self-concordant. Participants become more focused on the impact of their goals and the wider meaning for attaining them. Importantly, previous research indicates an increase in well-being associated with self-concordant goals (Sheldon & Elliot, 1999). Therefore, future research might usefully focus on substantiating any connection between objective measures (e.g., THS) and the changes in goals identified here.

Fitting into the Thesis and Chapter Summary

The diary study, considered within the wider context of this thesis, provides our final evidence in support of 1) the operation of BBH in relation to character strengths, and 2) its extension to CF. Participants completing the GRT in both single-session contexts (i.e., Study 6) and the repeated context (i.e., here, Study 7), showed improved CF (i.e., via AUT performance; Guildford et al., 1978). Moreover, the findings from Chapter 7 serve as further support for the GRT's efficacy as an intervention; participants are seen to increase in hope and

decrease in negativity. Finally, in this broad spectrum of participants appear to enjoy GRT-based activity, consistently finding value in the process of reflection, regardless of objective outcome. The broader implications of this research, and that presented in the collected empirical chapters of this thesis are discussed further in the following *General Discussion* chapter.

Chapter 9: General Discussion

This thesis sought to address three key questions. First, can the operation of BBH (Fredrickson, 2001) extend to character strengths (i.e., beyond general positive affect)? In other words, do character strengths enable people to *broaden and build*? Second, can the operation of BBH extend to include Cognitive Flexibility (CF; i.e., rather than lower level cognition)? Third, building on these questions, do simple strengths-based interventions (applied generally, and hope-specific) impact on performance in CF tasks? Finally, an overarching theme has been the use of a Mixed Methods (MM) design, and its pivotal role in gaining insight into the findings presented here. Particularly of note, use of this approach has highlighted the differences between qualitative and quantitative data strands, and the improved holistic perspective enabled by their convergence.

The extent to which these questions can be answered will be addressed below. A brief summary of each study will be presented, followed by a review of the methodologies used in this thesis (i.e., MM, interventions, CF paradigms). Finally, theoretical implications, and suggestions for future directions based on the finding of this research will be presented.

Summary of Results

Card Sorting Task (CST): Studies 1-3

In this first cluster of studies, the CST was used as a ‘pseudo-intervention’ (see *Chapter 4*) to explore effects on performance in CF paradigms. In Study 1, using Navon Task (NT, Navon, 1977) experimental and control conditions were quantitatively comparable (i.e., similar RT/Accuracy). Qualitative data highlighted a mixed reaction to the CST; while broadly positive, some participants suggested the CST was detrimental to NT performance. Considered together, these data suggested some CST efficacy in enabling strengths-reflection; however, they also highlighted a potential ceiling effect in performance (i.e., NT demand did not require sufficient CF). By using a NT, Study 1 aligned the thesis with previous BBH

literature (i.e., Fredrickson & Branigan, 2005; Garland et al., 2010) and presented a potential baseline for how we consider CF task demands.

Study 2 built on this approach, by engaging participants in a higher CF demand paradigm; namely the Adaptive Choice Task (ACT; Irons & Leber, 2015). Interestingly, despite higher cognitive demands, the quantitative data were similar to Study 1; experimental and control group performance was comparable (i.e., similar RT, Accuracy, Optimality). In contrast, the qualitative findings were more cohesive, identifying the CST as broadly positive, and potentially motivating better ACT performance (cf. quantitative data). These findings (combined with Study 1) indicated the potential relevance of CF beyond the cognition required perceptuo-attentional tasks. In turn, this facilitated investigation focusing on an important aspect of the original BBH studies, i.e., thought-action repertoires (TAR; Fredrickson & Branigan, 2005).

In Study 3, a traditional measure of divergent thinking (e.g., Gilhooly et al., 2007) was used; the Alternative Uses Task (AUT; Guilford et al., 1978). In contrast to the first two studies, here, quantitative evidence suggested that participants assigned to the experimental condition performed better than control counterparts. Specifically, experimental participants generated 1) more alternative uses with 2) fewer errors, 3) increased elaboration and a 4) wider range of categories. Moreover, the qualitative data indicated the CST to be beneficial, with an apparent increase in wellbeing and motivation. However, participants also reflected on the negative CST category (i.e., Weaknesses), with some indication that participants created a self-imposed dichotomy. In other words, they considered whatever is not a strength *must* be a weakness.

Considering Studies 1-3 together, two main conclusions were drawn. First, the CST lacked specificity, and due to its passive design, this potentially impacted on its efficacy. Second, CST-related interventions were able to 'activate' BBH (Fredrickson, 2001), although only when CF demand was high (i.e., more than a simple behavioural response was required). At this point, a novel, active intervention was designed, 1) to focus on a specific character strength (i.e., hope), and 2) in order to address limitations identified in Studies 1-3.

Goal Reflection Task (GRT): Studies 4-6

The Goal-Reflection Task (GRT; see *Chapter 5*) was used in conjunction with the same CF paradigms presented in Studies 1-3 (i.e., NT, ACT, AUT). In addition, a second experimental group was added to examine the potential impact of participant awareness of the intervention's purpose (i.e., Implicit or Explicit instructions). Moreover, to determine any individual differences-based changes (e.g., in state/trait hope) questionnaires were also included pre- and post- GRT (e.g., THS; Snyder et al., 1991).

In Study 4 (i.e., NT; Navon, 1977, see *Chapter 5*), as with Study 1, no NT performance differences were seen between conditions (i.e., similar RT/Accuracy). That said, Implicit Instruction participants were more hopeful (i.e., increased SHS, THS) after completing the GRT, and both Implicit and Explicit Instruction participants had a decrease in negativity (i.e., PN). Further, indirect association between GRT and NT performance was recognized (i.e., GRT predicted trait hope, and hope, state and trait, predicted NT performance). The qualitative data provided further support for GRT efficacy; here most positive experience was seen for Implicit Instruction participants. Much like Study 1, the NT allowed an effective baseline for CF performance after completing the GRT to be established. Moreover, it also allowed an initial answer to one of the overarching questions: BBH cannot be extended to CF when measured by NT performance.

The ACT (Irons & Leber, 2015) was used to assess CF in Study 5, highlighting more complex task demands and performance measures (see *Chapter 6*). Behaviourally, no differences were seen between conditions (i.e., similar RT, Accuracy, and Optimality). However, GRT efficacy evaluation showed consistent improvement in levels of hope (i.e., SHS and THS increases at Time 2), as well as reduction in negativity (cf. Explicit Instruction condition). Increased engagement in the GRT (i.e., writing more extensively) also predicted subsequent increases in hope (Agency subscale). Overall, in the qualitative data, the GRT was considered both positive and enhancing for ACT performance.

Taken together, Studies 4 and 5 (and Studies 1-2) indicate that strengths-based interventions (or at least, not the ones presented here) have no consistent performance effect on CF (i.e., as evident within the NT and ACT paradigms). That said, tentative evidence from qualitative and quantitative data strands highlighted a predictive relationship between hope and optimality (i.e., in Study 5, T1 hope predicted optimality, and optimality predicted hope at T2). Plainly, more hopeful participants were more optimal, a relationship that was further explored in Study 6 (i.e., through creative, divergent thinking).

The final study of the second series of studies investigates the effect of the GRT on AUT (Guilford et al, 1978) performance. Here, participants who completed the GRT demonstrated higher levels of CF (i.e., more alternative uses, fewer errors, with more elaboration, and more categories of use). In contrast, the questionnaire data (cf. Studies 4-5), there were no differences in hope (state or trait) between Times 1 and 2. However, experimental participants had reduced negativity (i.e., PN) at Time 2. The qualitative data indicated the GRT was a positive experience, with participants identifying the helpful and beneficial nature of the GRT generally, and specifically on AUT performance.

Based on Studies 4-6, the GRT appeared a positive experience for experimental participants. Indeed, some participants suggested the activity was a practice they might repeat or continue beyond participation. Quantitatively, the data demonstrated little impact was seen on less complex CF-demand tasks (i.e., NT, ACT), however, GRT participants outperformed their control counterparts on higher CF demand, creative/fluency tasks (i.e., AUT). Finally, given the improved intervention efficacy of the GRT (i.e., increases on hope/affective measures, improvement on CF tasks), the last empirical study explored this intervention in a more naturalistic (and applied) setting.

Goal-Diary: Study 7

The GRT was adapted into a diary format, to focus on daily goal-oriented reflection, as opposed to previously-attained goals. Participants undertook the diary task for seven days; questionnaire (i.e., THS, Snyder et al, 1991) and AUT

performance were compared pre- and post-intervention. The findings from Study 7 demonstrated clear improvement in CF (as indicated by AUT performance) post-intervention, as well as increases in state hope, trait agency, and reduction in negativity. In addition, qualitative data from the study provided more nuanced insight into the mechanisms and advantages underlying goal-oriented reflection (e.g., enhancing clarity/focus in participants). Considering Studies 4-7 as a group, we can reiterate the effectiveness of the GRT as a positivity intervention; specifically, it reduced negativity, increased hope, and improved aspects of CF performance.

Answering the Research Questions... (possibly)

Considering the empirical data above, it is difficult to be entirely conclusive in answering the questions posed at the outset. However, that does not mean we cannot draw *any* conclusions. With our first question- ‘does the operation of BBH extend to character strengths?’; for the most part, yes. Quantitative data pointed towards enhanced T-AR in studies where this was measured (i.e., Studies 3, 6, and 7). Importantly, these data remain consistent with the original BBH research (e.g., Fredrickson & Branigan, 2005). However, in context, the character strength (quasi-) interventions adopted were either 1) not sufficient to impact on subsequent less complex CF tasks, or 2) the increase in positivity elicited by these (via character strength ‘induction’) was unable to produce the behavioural advantages observed by Fredrickson and Branigan. That is, at least as far as lower-level cognition and/or less complex CF (e.g., global/local perceptual processing/NT, respectively) is concerned.

For our second question ‘Can the operation of BBH extend to CF?’, once again, the answer is not straightforward. Certainly, evidence suggests BBH and more complex CF (i.e., optimality, creativity) share some components (i.e., Studies 3, 6, and 7). That said, measures of less behaviourally complex CF (e.g., NT RT/accuracy) do not appear to benefit from the inclusion of (potentially) BBH-activating intervention. The implications of these differences are considered further below (see *Theoretical Implications: Adaptive Optimality*).

Our final question was ‘do simple strengths-based interventions (whether general or specific) impact on CF performance?’ Yes, but again only when CF demand is complex. For example, in both CST and GRT interventions, little effect was seen on both NT (Navon, 1977; Studies 1 & 4) and ACT (Irons & Leber, 2015; Studies 2 & 5) performance, but differences between experimental and control groups were seen in AUT performance (Guildford et al, 1978; Studies 3, 6, and 7). Interestingly, on subjective experiential report alone, intervention participants considered this activity a beneficial experience; specifically, GRT participants expressed a belief that CF task performance was supported.

Evaluation of Methodologies

Mixed Methods and Convergent Data

As noted above, one of the most important aspects of the thesis to emerge *a posteriori* is the use of Mixed Methods (MM) designs throughout. Briefly, MM designs use a mix of qualitative- and quantitative-related techniques (e.g., viewpoints, perspectives, data collection and analysis techniques; Johnson et al., 2007) in order to obtain optimal understanding of behaviour by data strand integration (Creswell & Plano Clark, 2017). MM are particularly important here, as they allow for the same focus of investigation to be explored from different methodological standpoints. The theoretical framework for and applications of MM are more comprehensively detailed in Chapter 3; however, the key issue here is that the importance of data strand convergence should be emphasized.

For example, converging the data in all three CST studies (Studies 1-3) allowed for inconclusive quantitative data to be interpreted, despite lack of clear statistically-significant effects. On a more general level, converging the data from Studies 1-3 has also allowed more effective evaluation of the CST. Whereas a ‘broad-brush’ evaluation would simply designate this an ineffective ‘intervention’ (or quasi-intervention), a MM approach has allowed assessment of participants’ subjective experience of the CST. This includes their non-quantitative behaviour (e.g., experience of character strength reflection) alongside more simplistic

performance quantification (e.g., RTs and accuracy). This depth of evaluation enabled development of subsequent strengths-based interventions and subsidiary tasks (e.g., GRT).

Beyond impact on the findings, the MM approach has enabled the individual to remain ‘central’ to each study. At its core, this thesis has explored aspects of classical individual differences, and these can easily be overlooked, over-generalized, or worse, deliberately ignored in contrast to numerical performance data. Given the focus here is on gaining holistic understanding of the effects of character strengths (e.g., here, via the impact of quasi- and full interventions), combining the subjective and objective aspects of performance is critical.

Using the GRT as an example, similarly to the CST, it is possible to argue the intervention was not effective (or only partially effective). In Study 4, no objective differences were observed (i.e., no RT /accuracy differences between conditions), however, participants considered the GRT to be a performance aid (e.g., *“I (think) I performed better. Afterwards, I felt strangely accomplished about the whole thing”*). Again, participants’ subjective experience of the GRT enables closer review of its ‘efficacy’. Here, as participants enjoyed the task and expressed positivity in its evaluation, it may have impacted on their overall mental state and affect. Thus, while qualitative findings will not replace quantitative ones (or vice versa), there is a level of understanding that is arguably reached only by combining both approaches.

Intervention Issues

Aside from the technical debate regarding what does/does not comprise an ‘intervention’ (see e.g., Meyer et al., 2012; Niemiec, 2018), there are a number of issues from the literature that can be examined via the methodological choices in this thesis. A neat example of this is encapsulated by the two formulations of the GRT (i.e., in Studies 4-6 and Study 7). Studies 4-6 presented the intervention in a brief format, requiring reflection on a previously-achieved goal, on a single occasion (i.e., in the testing session). Conversely, Study

7 developed this protocol into a week-long format, requiring daily reflection on goals set prior to the session in question, and goals set for subsequent ones.

The debate regarding efficacy of single versus multi-session PP interventions (Weis and Speridakos; 2011) could be evaluated here in a particularly elegant way. Essentially, the two tasks were equivalent; differences were mainly attributable to repetition of the GRT. In fact, the results were also comparable; both found increases in hope, decreases in negativity, and increases in CF.

The PP intervention debate also extends to sample and ecology (i.e., clinical samples versus student samples, laboratory versus 'natural' environments), reflected in the review by Weis and Speridakos (2011). Thus, is our understanding of PP interventions efficacy skewed by methodological limitations? While there were no clinical samples in this thesis, the sample recruited for Study 7 (i.e., Ordained clergy, Office workers, Students) could be seen as particularly diverse. At a surface level, performance was equivalent across all groups, with no evidence of GRT x Group interactions. In addition, the GRT was presented in laboratory *and* naturalistic (e.g., home) environments, and was effective in both. Clearly, this comparison does not eradicate Weis and Speridakos' (2011) general concerns around PP interventions. However, it does point towards a robust GRT intervention which can have impact independently of those factors that can disrupt efficacy (i.e., environment). Moreover, exploring application of the GRT to clinical populations (e.g., anxiety) would be an interesting extension of the work presented here (see *Future Directions* below).

With some serendipity, these data can also speak to a new debate regarding *intervention personalisation* (Ruch et al., 2020). The debate centres on how subjective an intervention should be, either focusing on strengths generally, or only on a participant's (identified) signature strength. Importantly, Ruch et al., also caution researchers against using 'wellbeing' as a default outcome measure, suggesting instead a broader focus on impact of strengths-based interventions. By only validating strengths-based interventions in terms of improved wellbeing severely limits any potential wider application. By broadening the focus of the

current thesis to include acknowledged higher-level cognitive function (i.e., CF), the application of PP interventions has also been widened.

In terms of how the work in this thesis aligns with this debate, again the GRT provides useful examples. The GRT is clearly grounded in the classic hope literature (e.g., Snyder et al., 1991), but allows for a high degree of subjectivity/ personalisation by focusing on goal-attainment as defined *by the participant*. Thus, no emphasis is placed on the personal significance or importance of the goal. In contrast, participants are instructed to reflect only on a goal meaningful to them, regardless of perceived value (e.g., societally, ethically, etc.).

However, this is not to say that intervention personalization does not have its limits. Specifically, while participants' subjective experience of the interventions has been positive, this is not a universal experience. Some have found reflection on goals a reminder of how little they have achieved, or comment on the restrictiveness of goal-setting as a task. While this does not change the implication of Ruch et al.'s conclusion that further research is needed to 'settle the debate', divergence in our findings can speak directly to this point. It is clear that not every intervention will work for everyone. In fact, arguably one of the most important advantages of using such interventions (i.e., that allow for experiential divergence) is that they 'tap into' individual differences more directly. Thus, interventions that are not enjoyed, or indeed, completed, may emerge as a behavioural diversion, and need not be considered further.

In summary, the work presented in this thesis has made a novel contribution to understanding of PP interventions. By using a range of CF performance measures, we have demonstrated application of PP interventions to more traditional cognitive constructs. Moreover, potential insight has been gained into several current debates in the literature (i.e., personalization versus generalisation, controlled versus natural environments, etc.).

CF Measures

Another point of debate is the choice not to use traditional measures of CF in this thesis (e.g., WCST; Grant & Berg, 1948. See *Chapter 2*). The primary motivation for this choice was to ‘capture’ CF behaviour as it manifests in ‘realistic’ cognitive/behavioural environments. In view of the work above, this choice was apt, and the validity of our definition of CF has been supported in both pragmatic (i.e., the AUT measured more complex CF) and literature-based (i.e., consistent with previous research, e.g., Diamond, 2014; Canas et al., 2003 etc.,) terms.

In fact, we could assert these aspects point towards a more pragmatic understanding of CF overall, and more specifically, how it can be enhanced via intervention. This enables clearer perspective on the scope of CF behaviour, especially, where little performance impact is seen for lower level cognition (i.e., RTs/ Accuracy on attentional tasks; e.g., NT, ACT), and substantial performance changes are seen for higher order aspects (i.e., optimality, creativity, e.g., AUT). In the context of this thesis, the ‘realistic’ aspects of CF that were successfully enhanced relate only to these higher-level facets.

However, as yet we have no data to demonstrate how these findings would map onto more traditional measures of CF (e.g., CFI; Dennis & Vander Wal, 2010). Therefore, a ‘back-filling’ process would make a useful next step for this research, either alongside the newly-validated GRT intervention, or other more ‘tried and tested’ PP interventions (e.g., The Hope Game; Pedrotti et al., 2008). It is important to note that limitations of these traditional measures still stand (i.e., target sample for the WCST; Grant & Berg, 1948). Indeed, it is not controversial to signpost their frequent use with cognitively-impaired participants (e.g., Korte et al., 2002). Therefore, application where CF has been enhanced (i.e., rather than viewed in relation to behavioural deficit) would provide a clear extension to these traditional measures.

Finally, use of non-traditional measures of CF (i.e., NT, ACT) has been well-explored, both here and in previous chapters (see *Chapters 4-7*); these

arguments will not be repeated here. That said, their use has allowed for potential update of CF conceptualization to be suggested (see *Redefining CF* below); use of CF as an umbrella term may be too broad and as a result, complicate matters unnecessarily. Interestingly, the majority of strengths and weaknesses attributed to CF paradigms used here were dependent on convergence of qualitative and quantitative data. Naturally, this reinforced the importance of a MM approach to the findings presented in this thesis.

Theoretical Implications

For many theses, there will be more questions that emerge from the research than originally envisaged (i.e., in research questions and overarching aims). Similarly, for each question that is answered, another will spring up in its place. Thus, this section of the general discussion allows an opportunity to explore the implications of our findings, relating these to the wider literature, and speculating on their potential to contribute further.

BBH and Character Strengths

One of the key questions addressed in this chapter is the operation of BBH as it applies to Character Strengths, and evidence to support this connection has been detailed above (see *Summary of Results*). In answering this question, this empirical work has also provided an important extension to the theoretical framework of the BBH. This extension is not entirely novel; in fact, the literature holds the assumption that character strengths elicit positive emotions (see Güsewell & Ruch, 2012). More specifically, the assumed relationship between hope and positive affect is ubiquitous in both textbooks (e.g., *The Oxford Handbook of Hope*; Lopez & Snyder, 2018), and research literature (e.g., Snyder et al, 1991; 2002; Bruininks & Howington, 2018; Marques et al, 2011, etc.). The evidence presented in this thesis provides robust support for this notion, confirming the intuitive assumption.

A Triadic Relationship?

By now, a number of clear findings have been established, speaking directly to the original research questions. Take for example, the finding that GRT participation effectively increases hope levels and improves complex CF performance. On closer inspection, this relationship is not straightforward; while the GRT improves CF performance, this is indicated by creativity- and fluency-style measures only (i.e., AUT Fluency, Flexibility, Elaboration); or T-AR as mentioned above (see *BBH and Character Strengths*). Moreover, the GRT also appears to augment positive individual differences (PIDs; e.g., increased state/trait hope, decreased negativity; see Studies 4-7 for evidence of both points). However, even when CF complexity demand is not substantially increased by the CF task (e.g., Study 5; increased PIDs, no impact on RT/accuracy-based CF performance), hope levels still predict Optimality performance (i.e., a CF measure). Note, Optimality is considered here as a ‘half-way’ measure between simple and complex CF. Thus, a consistent, static ‘picture’ is not easy to fix; at an intuitive level, however, there appears some interrelation between goal reflection, PIDs and complex CF: see Figure 53.

In the specific context of this thesis then, there is highly tentative evidence for form of dynamic and complex triadic relationship between the act (and psychological outcomes) of Goal Reflection, task/resources demands that draw on more complex forms of CF, and enhanced (or enhancement of) PIDs. This allows a speculative and pragmatic extension to the BBH framework (Fredrickson, 2001) on which this empirical work is based. By analogy, the act of goal reflection per se could also be considered a ‘catalyst’, effectively boosting both CF performance and PIDs in certain circumstances.

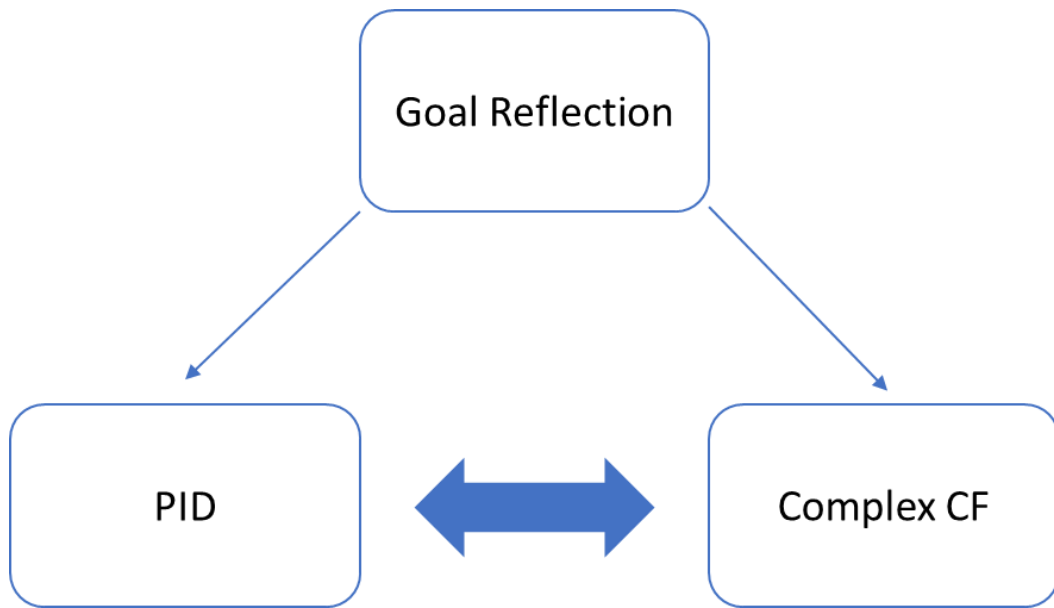


Figure 53. Hypothesised triadic relationship between PID, Complex CF, and the goal reflection.

That said, and less tentatively, there is also evidence to support *direct* relationships between hope and CF. For example, Study 5 demonstrated that GRT participation did not affect ACT performance but did increase levels of hope. Indeed here, levels of trait hope predicted Optimality scores (i.e., a ‘moderately complex’ facet of CF; see above). Certainly, considerable investigation is required 1) to consolidate the existence of such triadic interrelation, 2) to examine its components and mechanisms in more detail, and 3) to explore aspects of directionality, causality and equilibrium. Overall, rather than vague speculation of some form of interconnectedness, we need to establish to what extent (if any) these three concepts actually interact, and how far we can crystallize their psychological definition? However, for subsequent theoretical ideas presented below, it is possible to argue that this potential interconnectedness is at least *conceptually* meaningful.

Distinctions in CF: Adaptive Optimality

Reflecting back to the key aims, this thesis focused on exploring the impact of BBH (specifically T-AR; Fredrickson, 2001) on higher order cognition—specifically, the construct of CF (e.g., an individual’s capacity to think/behave

adaptively in different environments; see *Chapter 2*). However, as this thesis progressed, it became more apparent, that even within our working definition of CF, more than one facet of this construct is evident. More concretely, two aspects of CF have potentially been identified, based on the data observed.

The first is a relatively straightforward variant of CF, where an individual is required to respond rapidly to their environment (e.g., a perceptuo-attentional task; NT, ACT); here, performance measures are typically restricted to simple behaviour (i.e., RT, Accuracy). Moreover, there is little room for CF performance that demonstrates any complexity or creativity. The second form does not require the same level of rapid reaction, but instead focuses on the most appropriate response to the environment (i.e., optimality). In addition, participants need to react to their environment in novel ways (i.e., creativity), with a residual element of task efficiency (i.e., fluency). While both constructs fit broadly within our definition of CF, their respective behaviours (and potentially applications) are quite different.

Thus, it appears additional terminology may be needed to illustrate any inherent processing distinctions (i.e., faster, accurate response to simple environmental demands versus slower, more deliberate/divergent thinking). The term *Adaptive Optimality* (AO), capitalizes on the notion of optimality in ACT performance measures (i.e., where we start to conceptualize CF as an adaptively fitting response to task demands, rather than simply quick, accurate response). Naturally, this proposition is entirely speculative, based solely on the data in this thesis. In no way is this intended to replace well-established work that comprises the CF literature (e.g., Diamond, 2014; Canas et al., 2003; Yu & Lee, 2017; Moore & Malinowski, 2009 etc.). Instead, this is an attempt to highlight a behavioural distinction within CF phenomena, that may be worthy of further exploration.

For clarity, the construct of AO (based on the behaviour outlined above) indicates slower, more deliberate CF, in which an individual is called to problem-solve, be creative, or behave in a novel, original way. Simultaneously, that individual needs to maintain flexibility, efficiency and environmental-

appropriateness throughout the required processing. This is a narrower range of function than that more generally associated with CF (e.g., from task-switching to problem-solving and creativity etc.; see *Chapter 2*).

In the context of this thesis, the clearest evidence for differential conceptualization is in CF performance from the three 'CF' paradigms used (e.g., NT, ACT and AUT). Taking each in turn, we can also consider differential levels of CF resource demand. For example, RT and Accuracy responses in the NT (Navon, 1977) and ACT (Irons & Leber, 2015) require relatively lower-level, straightforward processing, represented with a simple behavioural response (i.e., button press).

However, it is possible to argue that this masks the additional layers of CF processing required. For instance, the NT required participants to track response type, while identifying the target letter; the ACT required participants to monitor/respond to multiple aspects of environmental stimuli (e.g., colour and number). In comparison, the more complex processing needed by the AUT (Guildford et al, 1987) and aspects of the ACT (i.e., Optimality; Irons & Leber, 2015) required participants to not only identify a target, but consider their strategy in how the target item is identified (e.g., *'if there are more blue squares I should switch to the red target'*) or manipulated (e.g., *'in what other ways might I use this item, or parts of this item?'*).

When we look at the effect of the GRT intervention on subsequent CF performance, we see little to no impact in more traditional measures of performance (i.e., NT RT/Accuracy, ACT RT/Accuracy), despite observing an increase in levels of hope *and* a decrease in negativity. However, when task demands move beyond CF in its simplest form (i.e., ACT optimality measures; AUT creativity/fluency), performance differences are seen between intervention and control groups. Conversely, where we can infer 1) differential CF resource demands, and 2) see resulting group differences in performance, impact of the GRT on observational measures (i.e., levels of hope and/or affect) appears to be reduced. Thus, we could also suggest this indicates a threshold at which an AO-type CF mechanism replaces 'default' CF performance; here, as CF resource and

task demands increase, this necessitates the individual ‘working smarter, not harder’ for successful performance. As shown below (Figures 54 and 55), AO would apply to circumstances where this threshold has been reached (i.e., the more demanding a task in terms of CF complexity, the larger range of resources that are required).

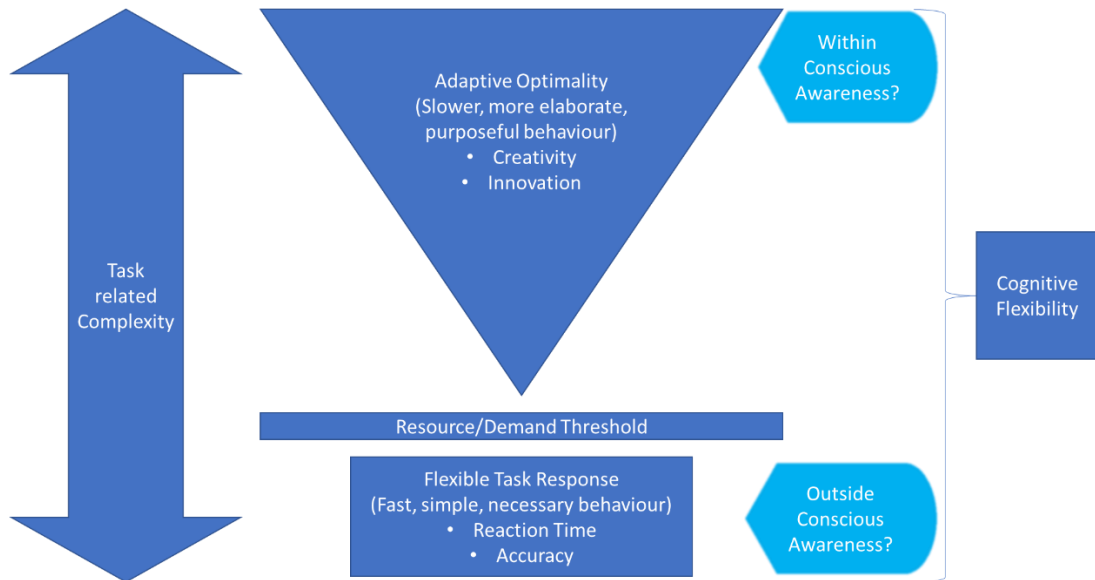


Figure 54. Theoretical depiction of Adaptive Optimality.

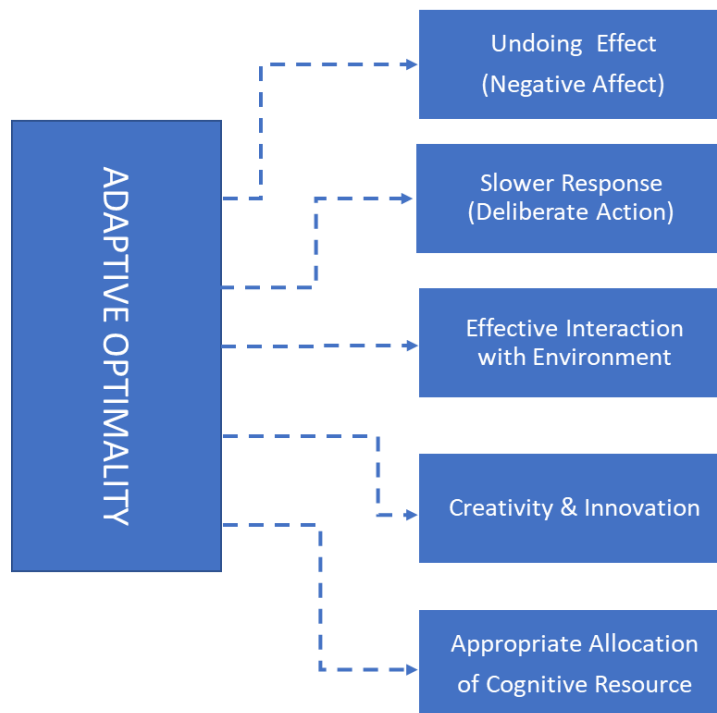


Figure 55. Simplified Adaptive Optimality model and associated behaviour.

Again, this is not an entirely novel idea, but instead ‘brings together’ an existing number of theories and ideas. For example, Fredrickson’s (2001) original proposition of the BBH was predicated on the idea that it fits a behavioural gap that fight or flight response creates (i.e., scenarios without immediate risk, or where risk has been processed/evaluated). However here, conceptualization of the T-AR is broadened further to refer to a more focused optimality mechanism (Figure 55). That is, an individual can use their CF resources in novel, more creative, and ultimately, more adaptive ways. For example, new ways of interacting with environmental stimuli (i.e., people, objects) may be more efficient or yield ‘better’ results. Intuitively, this suggestion makes sense; rapid, simple behavioural flexibility is required in situations where the individual is under threat (or here, where task/resource demand is low), but slower, more purposeful response would represent a clear disadvantage (similar to the ‘fast and slow’ systems of thinking described by Kahneman; 2011). However, under less immediate pressure, a more elaborative and meaningful response can be made with minimal risk. This could also be reflected in the need to inhibit an appropriate (but inefficient, or overly-simplistic) behaviour in order to adopt more complex CF (e.g., switching target colour in the ACT).

The concept of AO arguably also incorporates, the BBH-related ‘undoing effect’ which has been mentioned previously (e.g., Study 7; see *Chapter 2* for a review). In brief, the *undoing effect* (Fredrickson, Mancuso, Branigan & Tugade, 2011) indicates that positive affect *undoes* (i.e., counteracts) impact of negative affect. Thus, any increase in positivity might not be shown as positive affect per se, but as a reduction in negative affect (or negativity, more generally). Here, we might argue that any negative affect arises from undertaking the CF task or intervention; that is, the tasks are perceived as difficult, stressful, or challenging to the participant, due to task demands (and potentially, load on cognitive resource). Therefore, any positive affect experienced by participants who complete a ‘successful’ PP intervention (e.g., the GRT), may serve as a protective factor against such negativity, instead allowing effective task completion.

In contrast, we see lower CF in control participants, who by design, do not benefit from any ‘shielding’ effect of the intervention. Examining this negativity in light of the literature, Figure 54 could be adapted as a mirror image, to account for impact of negativity or anxiety (Fredrickson et al, 2011). For example, Attentional Control Theory (see Eysenck, Debrakshan, Santos & Calvo, 2007) suggests the role of anxiety in processing efficacy; specifically, slower processing of stimuli while greater effort is required, with this impact increasing as task-demand increases). That said, while Attentional Control Theory is relevant as an analogy to the suggestion above, the thesis has focused on positive affect, so in principle, it has minimal theoretical impact here.

The idea of AO described above is not intended to be a definitive model, but instead theoretical speculation based on these findings. Clearly, extensive work would be needed to support these propositions. While AO is grounded in previous literature (see *Chapter 2*) and based on the evidence from this thesis (see Studies 5-7), there are some clear directions for future scholarship.

Redefining CF

A final theoretical point is to revisit the definition of CF offered in Chapter 2: “the capability of an individual to think and behave adaptively in different environments” (pg. 57). In light of the AO concept outlined above, coupled with the data presented in this thesis, this definition may be too broad. A search of the term ‘Cognitive Flexibility’ in the literature database *Psychinfo* returned 711 results (2nd August 2020); cursory scanning of these abstracts suggested the definition above is commonplace. Thus, the prevalence of this definition, combined with the research presented here suggests a lack of specificity lends itself to CF acting as an ‘academic crucible’ for any higher-level cognition which cannot be readily defined. The point is not to criticize researchers for adopting this term, but instead propose a sub-definition for differential CF performance seen in this work (see *Figure 56*).

Returning to CF as an umbrella term, we could argue that AO sits as an ‘an umbrella under the umbrella’. Rather than trying to account for all cognition

which describes thinking/behaving adaptively to changing environments, instead focuses on functioning where resource and task demand is sufficiently high and CF sufficiently complex. Of most importance, this individuation/differentiation of CF can facilitate more effective evaluation of PP interventions (in turn, enabling more focused application), as performance changes that might be traditionally be overlooked can potentially be attributed to successful impact of the BBH.

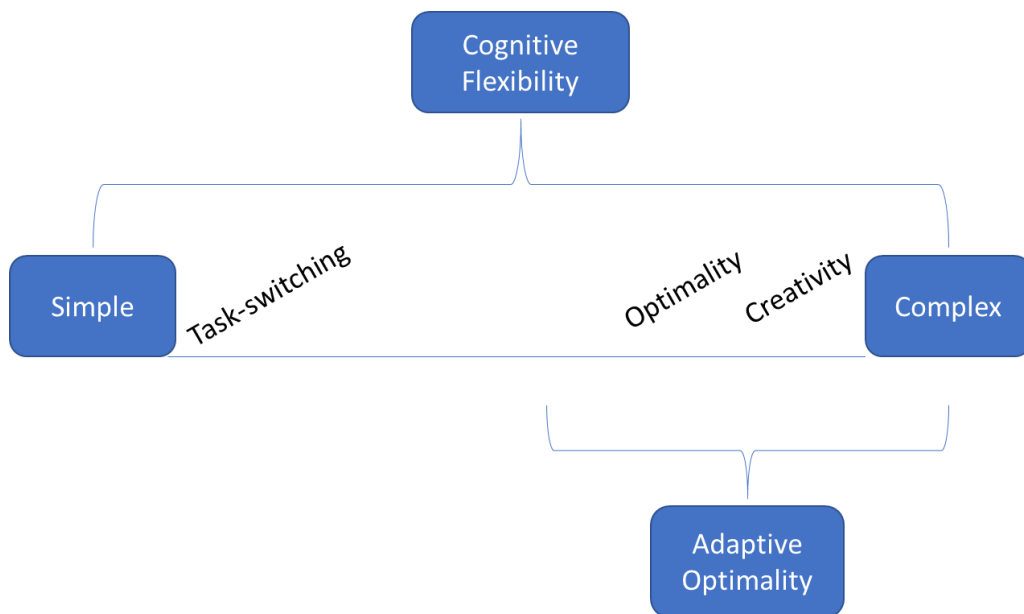


Figure 56. Visualization of how AO fits under the CF umbrella, with CF as a continuum.

Future Directions

Of course, it is natural to see more questions emerging from a body of empirical work, even as we are able to answer those few we set out to explore. There are three key areas that spring from our findings, and these fall in line with the arguments outlined above. These include 1) resource/demand/ behavioural thresholds, 2) goal-related behaviour, and 3) the further extension of BBH and the undoing effect.

Continuing with a MM approach, an innovative data collection method might be to ask participants to ‘narrate’ their subjective experience of undertaking a CF task. Obviously, by exploring subjective experience *during* an ongoing task (as opposed to *after*), this would likely impact on the cognitive load/task demands experienced, however it might also yield interesting insight

that cannot be gained unless the ‘narration’ of task experience is concurrent (i.e., adopting a very focused form of experience sampling; e.g., Scollon et al, 2003). Specifically, by using an exploratory design (see Creswell & Plano Clark, 2017), we can gain a more rounded understanding of processing, especially where mechanisms may not operate above the level of conscious awareness (i.e., Are participants aware of their shift towards AO? Do they recognise reaching a threshold? Are they aware of an undoing effect?). Moreover, this is in line with the suggestions for future research above (i.e., mapping current findings onto more traditional examination of the role of CF), and would provide further insight into where any thresholds may lie.

While not a key focus of this thesis, a robust and rich bank of data concerning goals and motivations for goal-achievement have been collected, which also provide a clear avenue for future research. The brief content analysis (see *Chapter 8: Supplementary Analysis*) conducted on the data from Study 7 is an example of how we could extend understanding of this behaviour. For example, similar representation of Goal categories across groups suggests a level of similarity in daily pursuits, regardless of individual circumstances. However, while goal types are similar, individual circumstances impact on how goals are described; social goals for Ordained/Office groups tend to relate to family, but friends/peers for Students). Here, it appears that goal *content* has little influence on outcomes we might apply to the behavioural/cognitive differences discussed above (i.e., increased CF). Simply put, the goal does not matter, but having one does.

Finally, this area of inquiry has potential for clearer understanding of specific character strengths (i.e., here, hope). Researchers (e.g., Aspinwall & Leaf, 2002) have already indicated a need for Snyder et al.’s (1991; 2002) conceptualization to be updated, specifically focusing on differences between agency and pathway in lay-persons’ understanding (Tong et al., 2010). More focused, person-centred analysis (e.g., thematic analysis, phenomenological analysis) would allow for goal-oriented behaviour and motivation to be explored in more detail. In turn, by understanding the experience of goal formation,

motivation, and attainment, we might better be able to support others in these processes.

Looking more closely, investigating type of goals set, in addition to differences between individuals and circumstances (e.g., occupation, age etc.), would give more transparency to how hope is evidenced within this behaviour set. Moreover, criticism (Tong et al., 2010) that pathway phenomena are represented less in the wider understanding of hope is consistent with our current findings (e.g., Study 7 found changes to trait agency but not to trait pathways). By exploring goal reflections, and looking for examples of pathways-thinking, or indeed examples of active compensation for encountered obstacles, we may yield deeper insight into this aspect of hope. Clearly, this is beyond the scope of this thesis, nevertheless gaining clearer understanding of goal-related behaviour (including firm definition of the phenomena it entails) would add important knowledge in this field.

Final remarks

PP interventions are still in their infancy (Ruch et al., 2020), therefore, we are in a privileged position that every advancement in the literature furthers understanding. The GRT and its application in this work highlights the potential impact of a PP intervention; alongside its real-world appeal to a broad audience. While by no means conclusive, this thesis provides a useful starting point by which the behavioural advantages of character strengths (and specifically, hope) can be explored. Finally, the link between character strengths and other (previously distinct) aspects of behaviour, such as adaptivity and complex cognitive behaviour, is particularly exciting, and an area that deserves more exploration.

References

- Akhtar, M., & Boniwell, I. (2010). Applying positive psychology to alcohol-misusing adolescents: A group intervention. *Groupwork*, 20(3), 6–31.
<https://doi.org/10.1921/095182410X576831>
- Alarcon, G. M., Bowling, N. A., & Khazon, S. (2013). Great expectations: A meta-analytic examination of optimism and hope. *Personality and Individual Differences*, 54(7), 821–827. <https://doi.org/10.1016/j.paid.2012.12.004>
- Amabile, T. M., Barsade, S. G., Mueller, J. S., & Staw, B. M. (2005). Affect and Creativity at Work. *Administration Science Quarterly*, 50(3), 367–403.
<https://doi.org/10.2189/asqu.2005.50.3.367>
- Anderson, M. C., & Green, C. (2001). Suppressing unwanted memories by executive control. *Nature*, 410(6826), 366–369.
<https://doi.org/10.1038/35066572>
- Anderson, M. C., & Levy, B. J. (2009). Suppressing Unwanted Memories. *Current Directions in Psychological Science*, 18(4), 189–194.
<https://doi.org/10.1111/j.1467-8721.2009.01634.x>
- Aspinwall, L. G., & Leaf, S. L. (2002). In Search of the Unique Aspects of Hope: Pinning Our Hopes on Positive Emotions, Future-Oriented Thinking, Hard Times, and Other People. *Psychological Inquiry*, 13(4), 276–321.
- Au, J., Sheehan, E., Tsai, N., Duncan, G. J., Buschkuehl, M., & Jaeggi, S. M. (2015). Improving fluid intelligence with training on working memory: A meta-analysis. *Psychonomic Bulletin & Review*, 22(2), 366–377.
<https://doi.org/10.3758/s13423-014-0699-x>
- Azorin, J. M., & Cameron, R. (2010). The Application of Mixed Methods in Organisational Research: A Literature Review. *Journal of Business Research Methods*, 8(2), 95–105.
- Badcock, C. R. (2000). *Evolutionary psychology: A critical introduction*. Polity Press Blackwell.
- Baddeley, A. (2010). Working memory. *Current Biology*, 20(4), 136–140.
<https://doi.org/10.1016/j.cub.2009.12.014>

- Bagozzi, R. P., & Pieters, R. (1998). Goal-directed Emotions. *Cognition & Emotion*, 12(1), 1–26. <https://doi.org/10.1080/026999398379754>
- Bakker, A. B., & van Woerkom, M. (2018). Strengths use in organizations: A positive approach of occupational health. *Canadian Psychology/Psychologie Canadienne*, 59(1), 38–46. <https://doi.org/10.1037/cap0000120>
- Barbey, A. K., Colom, R., & Grafman, J. (2013). Architecture of cognitive flexibility revealed by lesion mapping. *NeuroImage*, 82, 547–554. <https://doi.org/10.1016/j.neuroimage.2013.05.087>
- Benedek, M., Jauk, E., Sommer, M., Arendasy, M., & Neubauer, A. C. (2014). Intelligence, creativity, and cognitive control: The common and differential involvement of executive functions in intelligence and creativity. *Intelligence*, 46, 73–83. <https://doi.org/10.1016/j.intell.2014.05.007>
- Berg, C. J., Ritschel, L. A., Swan, D. W., An, L. C., & Ahluwalia, J. S. (2011). The Role of Hope in Engaging in Healthy Behaviors Among College Students. *American Journal of Health Behavior*, 35(4), 402–215. <https://doi.org/10.5993/ajhb.35.4.3>
- Berg, C. J., Snyder, C. R., & Hamilton, N. (2008). The Effectiveness of a Hope Intervention in Coping with Cold Pressor Pain. *Journal of Health Psychology*, 13(6), 804–809. <https://doi.org/10.1177/1359105308093864>
- Berthold, A., & Ruch, W. (2014). Satisfaction with life and character strengths of non-religious and religious people: It's practicing one's religion that makes the difference. *Frontiers in Psychology*, 5, 1–9. <https://doi.org/10.3389/fpsyg.2014.00876>
- Brand, J., & Johnson, A. P. (2014). Attention to local and global levels of hierarchical Navon figures affects rapid scene categorization. *Frontiers in Psychology*, 5, 1–19. <https://doi.org/10.3389/fpsyg.2014.01274>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>

- Bryman, A. (2006). Integrating quantitative and qualitative research: How is it done? *Qualitative Research*, 6(1), 97–113.
<https://doi.org/10.1177/1468794106058877>
- Bryman, A. (2007). Barriers to Integrating Quantitative and Qualitative Research. *Journal of Mixed Methods Research*, 1(1), 8–22.
<https://doi.org/10.1177/2345678906290531>
- Callina, K., Snow, N., & Murray, E. D. (2017). The History of Philosophical and Psychological Perspectives on Hope. In M. W. Gallagher & S. J. Lopez (Eds.), *The Oxford Handbook of Hope* (pp. 9–26). Oxford University Press.
- Cañas, J., Quesada, J., Antolí, A., & Fajardo, I. (2003). Cognitive flexibility and adaptability to environmental changes in dynamic complex problem-solving tasks. *Ergonomics*, 46(5), 482–501.
- Capp & Co. (2015). *Realise 2 Character Strengths Cards*. Capp & Co, Ltd.
- Carver, C. S., Scheier, M. F., Miller, C. J., & Fulford, D. (2009). Optimism. In S. J. Lopez & C. R. Snyder (Eds.), *The Oxford Handbook of Positive Psychology* (pp. 303–312). Oxford University Press.
- Cepeda, N. J., Kramer, A. F., & Gonzalez de Sather, J. C. M. (2001). Changes in Executive Control Across the Life Span: Examination of Task-Switching Performance. *Developmental Psychology*, 37(5), 717–730.
<https://doi.org/10.1037/0012-1649.37.5.715>
- Cheavens, J. S., Feldman, D. B., Gum, A., Michael, S. T., & Snyder, C. R. (2006). Hope Therapy in a Community Sample: A Pilot Investigation. *Social Indicators Research*, 77(1), 61–78. <https://doi.org/10.1007/s11205-005-5553-0>
- Cheavens, J. S., & Guter, M. M. (2017). Hope Therapy. In M. W. Gallagher & S. J. Lopez (Eds.), *The Oxford Handbook of Hope* (pp. 133–142). Oxford University Press.
- Chiu, Y.-C., & Egner, T. (2017). Cueing cognitive flexibility: Item-specific learning of switch readiness. *Journal of Experimental Psychology: Human Perception and Performance*, 43(12), 1950–1960.
<https://doi.org/10.1037/xhp0000420>

- Ciarrocchi, J. W., & Deneke, E. (2005). Hope, optimism, pessimism, and spirituality as predictors of well-being controlling for personality. *Research in the Social Scientific Study of Religion*, 16, 161–183.
- Ciarrocchi, J. W., Dy-Liacco, G. S., & Deneke, E. (2008). Gods or rituals? Relational faith, spiritual discontent, and religious practices as predictors of hope and optimism. *The Journal of Positive Psychology*, 3(2), 120–136. <https://doi.org/10.1080/17439760701760666>
- Ciarrochi, J. W., Heaven, P. C. L., & Davies, F. (2007). The impact of hope, self-esteem, and attributional style on adolescents' school grades and emotional well-being: A longitudinal study. *Journal of Research in Personality*, 41(6), 1161–1178. <https://doi.org/10.1016/j.jrp.2007.02.001>
- Cohen, S., & Pressman, S. D. (2006). Positive Affect and Health. *Current Directions in Psychological Science*, 15(3), 122–125. <https://doi.org/10.1111/j.0963-7214.2006.00420.x>
- Collins, K. M. T., Onwuegbuzie, A. J., & Jiao, Q. G. (2006). Prevalence of Mixed-methods Sampling Designs in Social Science Research. *Evaluation & Research in Education*, 19(2), 83–101. <https://doi.org/10.2167/eri421.0>
- Costa, P. T., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and Individual Differences*, 13(6), 653–665. [https://doi.org/10.1016/0191-8869\(92\)90236-I](https://doi.org/10.1016/0191-8869(92)90236-I)
- Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and Conducting Mixed Methods Research* (3rd ed.). SAGE.
- Crossley, M. L. (2001). Rethinking psychological approaches towards health promotion. *Psychology & Health*, 16(2), 161–177. <https://doi.org/10.1080/08870440108405497>
- Curry, L. A., Snyder, C. R., Cook, D. L., Ruby, B. C., & Rehm, M. (1997). Role of hope in academic and sport achievement. *Journal of Personality and Social Psychology*, 73(6), 1257–1267. <https://doi.org/10.1037/0022-3514.73.6.1257>
- Davidoff, J., Fonteneau, E., & Fagot, J. (2008). Local and global processing: Observations from a remote culture. *Cognition*, 108(3), 702–709. <https://doi.org/10.1016/j.cognition.2008.06.004>

- Day, L., Hanson, K., Maltby, J., Proctor, C., & Wood, A. (2010). Hope uniquely predicts objective academic achievement above intelligence, personality, and previous academic achievement. *Journal of Research in Personality*, 44(4), 550–553. <https://doi.org/10.1016/j.jrp.2010.05.009>
- Dennis, J. P., & Vander Wal, J. S. (2010). The Cognitive Flexibility Inventory: Instrument Development and Estimates of Reliability and Validity. *Cognitive Therapy and Research*, 34(3), 241–253. <https://doi.org/10.1007/s10608-009-9276-4>
- Diamond, A. (2005). Attention-deficit disorder (attention-deficit/ hyperactivity disorder without hyperactivity): A neurobiologically and behaviorally distinct disorder from attention-deficit/hyperactivity disorder (with hyperactivity). *Development and Psychopathology*, 17(03), 807–825. <https://doi.org/10.1017/S0954579405050388>
- Diamond, A. (2013). Executive Functions. *Annual Review of Psychology*, 64(1), 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Dick, A. S. (2014). The development of cognitive flexibility beyond the preschool period: An investigation using a modified Flexible Item Selection Task. *Journal of Experimental Child Psychology*, 125, 13–34. <https://doi.org/10.1016/j.jecp.2014.01.021>
- Diener, E. (2009). Positive Psychology: Past, Present, and Future. In C. R. Snyder & S. J. Lopez (Eds.), *Oxford handbook of positive psychology* (pp. 2–12). Oxford University Press.
- Dippo, C., & Kudrowitz, B. (2013). *Evaluating the alternative uses test of creativity*. National Conference on Undergraduate Research, University of Wisconsin La Crosse, WI.
- Dreu, C. K. W. D., Nijstad, B. A., & Baas, M. (2011). Behavioral Activation Links to Creativity Because of Increased Cognitive Flexibility. *Social Psychological and Personality Science*, 2(1), 72–80. <https://doi.org/10.1177/1948550610381789>
- Duchaine, B., Yovel, G., & Nakayama, K. (2007). No global processing deficit in the Navon task in 14 developmental prosopagnosics. *Social Cognitive and*

Affective Neuroscience, 2(2), 104–113.

<https://doi.org/10.1093/scan/nsm003>

Duncan, J., Parr, A., Woolgar, A., Thompson, R., Bright, P., Cox, S., Bishop, S., & Nimmo-Smith, I. (2008). Goal neglect and Spearman's g: Competing parts of a complex task. *Journal of Experimental Psychology: General*, 137(1), 131–148. <https://doi.org/10.1037/0096-3445.137.1.131>

Eli, J. A., Mohr-Schroeder, M. J., & Lee, C. W. (2011). Exploring mathematical connections of prospective middle-grades teachers through card-sorting tasks. *Mathematics Education Research Journal*, 23(3), 297–319. <https://doi.org/10.1007/s13394-011-0017-0>

Ellefson, M. R., Ng, F. F.-Y., Wang, Q., & Hughes, C. (2017). Efficiency of Executive Function: A Two-Generation Cross-Cultural Comparison of Samples From Hong Kong and the United Kingdom. *Psychological Science*, 28(5), 555–566. <https://doi.org/10.1177/0956797616687812>

Ellefson, M. R., Shapiro, L. R., & Chater, N. (2006). Asymmetrical switch costs in children. *Cognitive Development*, 21(2), 108–130. <https://doi.org/10.1016/j.cogdev.2006.01.002>

Eriksen, B. A., & Eriksen, C. W. (1974). Effects of noise letters upon the identification of a target letter in a nonsearch task. *Perception & Psychophysics*, 16(1), 143–149. <https://doi.org/10.3758/BF03203267>

Feldman, D. B., & Dreher, D. E. (2012). Can Hope be Changed in 90 Minutes? Testing the Efficacy of a Single-Session Goal-Pursuit Intervention for College Students. *Journal of Happiness Studies*, 13(4), 745–759. <https://doi.org/10.1007/s10902-011-9292-4>

Fernandez-Duque, D., Baird, J. A., & Posner, M. I. (2000). Executive Attention and Metacognitive Regulation. *Consciousness and Cognition*, 9(2), 288–307. <https://doi.org/10.1006/ccog.2000.0447>

Figueroa, I. J., & Youmans, R. J. (2012). Individual Differences in Cognitive Flexibility Predict Performance in Vigilance Tasks. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 56(1), 1099–1103. <https://doi.org/10.1177/1071181312561239>

- Frank, J. D. (1968). The influence of patients' and therapists' expectations on the outcome of psychotherapy. *British Journal of Medical Psychology*, 41(4), 349–356. <https://doi.org/10.1111/j.2044-8341.1968.tb02043.x>
- Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56(3), 218–226. <https://doi.org/10.1037//0003-066X.56.3.218>
- Fredrickson, B. L. (2004). The broaden-and-build theory of positive emotions. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 359, 1367–1377. <https://doi.org/10.1098/rstb.2004.1512>
- Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition & Emotion*, 19(3), 313–332. <https://doi.org/10.1080/02699930441000238>
- Fredrickson, B. L., Cohn, M. A., Coffey, K. A., Pek, J., & Finkel, S. M. (2008). Open hearts build lives: Positive emotions, induced through loving-kindness meditation, build consequential personal resources. *Journal of Personality and Social Psychology*, 95(5), 1045–1062. <https://doi.org/10.1037/a0013262>
- Fredrickson, B. L., & Losada, M. F. (2005). Positive Affect and the Complex Dynamics of Human Flourishing. *American Psychologist*, 60(7), 678–686. <https://doi.org/10.1037/0003-066X.60.7.678>
- Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The Undoing Effect of Positive Emotions. *Motivation and Emotion*, 24, 237–258. <https://doi.org/10.1023/a:1010796329158>
- Fredrickson, B. L., Tugade, M. M., Waugh, C. E., & Larkin, G. R. (2003). What good are positive emotions in crisis? A prospective study of resilience and emotions following the terrorist attacks on the United States on September 11th, 2001. *Journal of Personality & Social Psychology*, 84(2), 365–376. <https://doi.org/10.1037//0022-3514.84.2.365>
- Friedman, N. P., & Miyake, A. (2004). The Relations Among Inhibition and Interference Control Functions: A Latent-Variable Analysis. *Journal of*

- Experimental Psychology: General*, 133(1), 101–135.
<https://doi.org/10.1037/0096-3445.133.1.101>
- Fujita, K. (2011). On Conceptualizing Self-Control as More Than the Effortful Inhibition of Impulses. *Personality and Social Psychology Review*, 15(4), 352–366. <https://doi.org/10.1177/1088868311411165>
- Gable, S. L., & Haidt, J. (2005). What (and Why) is Positive Psychology? *Review of General Psychology*, 9(2), 103–110. <https://doi.org/10.1037/1089-2680.9.2.103>
- Gallagher, M. W. (2017). Introduction to the Science of Hope. In M. W. Gallagher & S. J. Lopez (Eds.), *The Oxford Handbook of Hope* (pp. 3–8). Oxford University Press.
- Gallagher, M. W., & Lopez, S. J. (2009). Positive expectancies and mental health: Identifying the unique contributions of hope and optimism. *The Journal of Positive Psychology*, 4(6), 548–556.
<https://doi.org/10.1080/17439760903157166>
- Gander, F., Proyer, R. T., Ruch, W., & Wyss, T. (2012). The good character at work: An initial study on the contribution of character strengths in identifying healthy and unhealthy work-related behavior and experience patterns. *International Archives of Occupational and Environmental Health*, 85(8), 895–904. <https://doi.org/10.1007/s00420-012-0736-x>
- Garland, E. L., Fredrickson, B. L., Kring, A. M., Johnson, D. P., Meyer, P. S., & Penn, D. L. (2010). Upward spirals of positive emotions counter downward spirals of negativity: Insights from the broaden-and-build theory and affective neuroscience on the treatment of emotion dysfunctions and deficits in psychopathology. *Clinical Psychology Review*, 30(7), 849–864. <https://doi.org/10.1016/j.cpr.2010.03.002>
- Gasper, K., & Clore, G. L. (2002). Attending to the big picture: Mood and global versus local processing of visual information. *Psychological Science*, 13(1), 34–40. <https://doi.org/10.1111/1467-9280.00406>
- Gasper, K., Spencer, L. A., & Middlewood, B. L. (2019). Differentiating hope from optimism by examining self-reported appraisals and linguistic content.

- The Journal of Positive Psychology*, 15(2), 220–237.
<https://doi.org/10.1080/17439760.2019.1590623>
- Gillham, J. E., & Seligman, M. E. P. (1999). Footsteps on the road to a positive psychology. *Behaviour Research and Therapy*, 37, 163–S173.
- Gilman, R., Dooley, J., & Florell, D. (2006). Relative Levels of Hope and Their Relationship With Academic and Psychological Indicators Among Adolescents. *Journal of Social and Clinical Psychology*, 25(2), 166–178.
<https://doi.org/10.1521/jscp.2006.25.2.166>
- Gonzalez, C. A., Figueroa, I. J., Bellows, B. G., Rhodes, D., & Youmans, R. J. (2013). A New Behavioral Measure of Cognitive Flexibility. In D. Harris (Ed.), *Engineering Psychology and Cognitive Ergonomics. Understanding Human Cognition* (Vol. 8019, pp. 297–306). Springer Berlin Heidelberg.
http://link.springer.com/10.1007/978-3-642-39360-0_33
- Gopher, D., Armony, L., & Greenshpan, Y. (2000). Switching tasks and attention policies. *Journal of Experimental Psychology: General*, 129(3), 308–339.
- Grant, D. A., & Berg, E. A. (1948). A behavioral analysis of degree of reinforcement and ease of shifting to new responses in a Weigl-type card-sorting problem. *Journal of Experimental Psychology*, 38(4), 404–411.
- Guilford, J. P., Christensen, P. R., Merrifield, P. R., & Wilson, R. C. (1978). *Alternate Uses: Manual of instructions and interpretations*. Mind Garden, Inc.
- Gum, A. M. (2017). *Promoting Hope in Older Adults* (M. W. Gallagher & S. J. Lopez, Eds.; Vol. 1). Oxford University Press.
<https://doi.org/10.1093/oxfordhb/9780199399314.013.13>
- Güsewell, A., & Ruch, W. (2012). Are only Emotional Strengths Emotional? Character Strengths and Disposition to Positive Emotions: Character Strengths and Dispositional Positive Emotions. *Applied Psychology: Health and Well-Being*, 4(2), 218–239. <https://doi.org/10.1111/j.1758-0854.2012.01070.x>
- Hanson, W. E., Creswell, J. W., Clark, V. L. P., Petska, K. S., & Creswell, J. D. (2005). Mixed methods research designs in counseling psychology.

- Journal of Counseling Psychology*, 52(2), 224–235.
<https://doi.org/10.1037/0022-0167.52.2.224>
- Hayes, T. R., Petrov, A. A., & Sederberg, P. B. (2015). Do we really become smarter when our fluid-intelligence test scores improve? *Intelligence*, 48, 1–14. <https://doi.org/10.1016/j.intell.2014.10.005>
- Heintz, S., Kramm, C., & Ruch, W. (2019). A meta-analysis of gender differences in character strengths and age, nation, and measure as moderators. *The Journal of Positive Psychology*, 14(1), 103–112.
<https://doi.org/10.1080/17439760.2017.1414297>
- Holmboe, K., & Johnson, M. H. (2005). Educating executive attention. *Proceedings of the National Academy of Sciences*, 102(41), 14479–14480.
<https://doi.org/10.1073/pnas.0507522102>
- Hood, A., Pulvers, K., Carrillo, J., Merchant, G., & Thomas, M. D. (2012). Positive traits linked to less pain through lower pain catastrophizing. *Personality and Individual Differences*, 52(3), 401–405.
<https://doi.org/10.1016/j.paid.2011.10.040>
- Hsieh, H.-F., & Shannon, S. E. (2005). Three Approaches to Qualitative Content Analysis. *Qualitative Health Research*, 15(9), 1277–1288.
<https://doi.org/10.1177/1049732305276687>
- Irons, J. L., & Leber, A. B. (2016). Choosing attentional control settings in a dynamically changing environment. *Attention, Perception, & Psychophysics*, 78(7), 2031–2048. <https://doi.org/10.3758/s13414-016-1125-4>
- Irons, J. L., & Leber, A. B. (2018). Characterizing individual variation in the strategic use of attentional control. *Journal of Experimental Psychology: Human Perception and Performance*, 44(10), 1637–1654.
<https://doi.org/10.1037/xhp0000560>
- Isen, A. M. (1987). Positive Affect, Cognitive Processes, and Social Behavior. *Advances in Experimental Social Psychology*, 20, 203–253.
[https://doi.org/10.1016/S0065-2601\(08\)60415-3](https://doi.org/10.1016/S0065-2601(08)60415-3)

- Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. *Field Methods*, 18(1), 3–20. <https://doi.org/10.1177/1525822X05282260>
- Jackson, W. T., Taylor, R. E., Palmatier, A. D., Elliott, T. R., & Elliott, J. L. (1998). Negotiating the reality of visual impairment: Hope, coping, and functional ability. *Journal of Clinical Psychology in Medical Settings*, 5(2), 173–185.
- Jaeggi, S. M., Buschkuhl, M., Jonides, J., & Perrig, W. J. (2008). Improving fluid intelligence with training on working memory. *Proceedings of the National Academy of Sciences*, 105(19), 6829–6833. <https://doi.org/10.1073/pnas.0801268105>
- Johnson, K. J., & Fredrickson, B. L. (2005). ‘We All Look the Same to Me’: Positive Emotions Eliminate the Own-Race Bias in Face Recognition. *Psychological Science*, 16(11), 875–881. <https://doi.org/10.1111/j.1467-9280.2005.01631.x>
- Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research*, 1(2), 112–133. <https://doi.org/10.1177/1558689806298224>
- Jurado, M. B., & Rosselli, M. (2007). The Elusive Nature of Executive Functions: A Review of our Current Understanding. *Neuropsychology Review*, 17(3), 213–233. <https://doi.org/10.1007/s11065-007-9040-z>
- Kahneman, D. (2011). *Thinking Fast and Slow* (1st ed.). Farrar, Straus and Giroux.
- Kane, M. J., Hambrick, D. Z., & Conway, A. R. A. (2005). Working Memory Capacity and Fluid Intelligence Are Strongly Related Constructs: Comment on Ackerman, Beier, and Boyle (2005). *Psychological Bulletin*, 131(1), 66–71. <https://doi.org/10.1037/0033-2909.131.1.66>
- Karbach, J., & Kray, J. (2009). How useful is executive control training? Age differences in near and far transfer of task-switching training: Transfer of task-switching training. *Developmental Science*, 12(6), 978–990. <https://doi.org/10.1111/j.1467-7687.2009.00846.x>
- Kelberer, L. J. A., Kraines, M. A., & Wells, T. T. (2018). Optimism, hope, and attention for emotional stimuli. *Personality and Individual Differences*, 124, 84–90. <https://doi.org/10.1016/j.paid.2017.12.003>

- Kessels, R. P. C., van Zandvoort, M. J. E., Postma, A., Kappelle, L. J., & de Haan, E. H. F. (2000). The Corsi Block-Tapping Task: Standardization and Normative Data. *Applied Neuropsychology*, 7(4), 252–258.
https://doi.org/10.1207/S15324826AN0704_8
- Klausner, E. J., Clarkin, J. F., Spielman, L., Pupo, C., Abrams, R., & Alexopoulos, G. S. (1998). Late-life depression and functional disability: The role of goal-focused group psychotherapy. *International Journal of Geriatric Psychiatry*, 13(10), 707–716. [https://doi.org/10.1002/\(SICI\)1099-1166\(199810\)13:10<707::AID-GPS856>3.0.CO;2-Q](https://doi.org/10.1002/(SICI)1099-1166(199810)13:10<707::AID-GPS856>3.0.CO;2-Q)
- Koch, I., Poljac, E., Müller, H., & Kiesel, A. (2018). Cognitive structure, flexibility, and plasticity in human multitasking—An integrative review of dual-task and task-switching research. *Psychological Bulletin*, 144(6), 557–583.
<https://doi.org/10.1037/bul0000144>
- Koesten, J., Schrod, P., & Ford, D. J. (2009). Cognitive Flexibility as a Mediator of Family Communication Environments and Young Adults' Well-Being. *Health Communication*, 24(1), 82–94.
<https://doi.org/10.1080/10410230802607024>
- Koestner, R., Lekes, N., Powers, T. A., & Chicoine, E. (2002). Attaining personal goals: Self-concordance plus implementation intentions equals success. *Journal of Personality and Social Psychology*, 83(1), 231–244.
<https://doi.org/10.1037/0022-3514.83.1.231>
- Kortte, K. B., Horner, M. D., & Windham, W. K. (2002). The Trail Making Test, Part B: Cognitive Flexibility or Ability to Maintain Set? *Applied Neuropsychology*, 9(2), 106–109.
https://doi.org/10.1207/S15324826AN0902_5
- Latham, G. P., Stajkovic, A. D., & Locke, E. A. (2010). The Relevance and Viability of Subconscious Goals in the Workplace. *Journal of Management*, 36(1), 234–255. <https://doi.org/10.1177/0149206309350777>
- Li, L., Worch, E., Zhou, Y., & Aguiton, R. (2015). How and Why Digital Generation Teachers Use Technology in the Classroom: An Explanatory Sequential Mixed Methods Study. *International Journal for the Scholarship of*

Teaching and Learning, 9(2), 1–9.

<https://doi.org/10.20429/ijstl.2015.090209>

Linkins, M., Niemiec, R. M., Gillham, J., & Mayerson, D. (2015). Through the lens of strength: A framework for educating the heart. *The Journal of Positive Psychology*, 10(1), 64–68.

<https://doi.org/10.1080/17439760.2014.888581>

Linley, P. A., Maltby, J., Wood, A. M., Joseph, S., Harrington, S., Peterson, C., Park, N., & Seligman, M. E. P. (2007). Character strengths in the United Kingdom: The VIA Inventory of Strengths. *Personality and Individual Differences*, 43(2), 341–351. <https://doi.org/10.1016/j.paid.2006.12.004>

MacLeod, C. M. (1992). The Stroop task: The ‘gold standard’ of attentional measures. *Journal of Experimental Psychology: General*, 121(1), 12–14.

<https://doi.org/10.1037/0096-3445.121.1.12>

Marques, S. C., Lopez, S. J., & Mitchell, J. (2013). The Role of Hope, Spirituality and Religious Practice in Adolescents’ Life Satisfaction: Longitudinal Findings. *Journal of Happiness Studies*, 14(1), 251–261.

<https://doi.org/10.1007/s10902-012-9329-3>

Marques, S. C., Lopez, S. J., & Pais-Ribeiro, J. L. (2011). “Building Hope for the Future”: A Program to Foster Strengths in Middle-School Students. *Journal of Happiness Studies*, 12(1), 139–152.

<https://doi.org/10.1007/s10902-009-9180-3>

Martin, M. M., & Anderson, C. M. (1998). The cognitive flexibility scale: Three validity studies. *Communication Reports*, 11(1), 1–9.

<https://doi.org/10.1080/08934219809367680>

Martin, M. M., & Rubin, R. B. (1994). Development of a Communication Flexibility Scale. *Southern Communication Journal*, 59(2), 171–178.

<https://doi.org/10.1080/10417949409372934>

Martin, M. M., & Rubin, R. B. (1995). A New Measure of Cognitive Flexibility. *Psychological Reports*, 76(2), 623–626.

<https://doi.org/10.2466/pr0.1995.76.2.623>

Martin, M. M., Staggers, S. M., & Anderson, C. M. (2011). The Relationships Between Cognitive Flexibility with Dogmatism, Intellectual Flexibility,

- Preference for Consistency, and Self-Compassion. *Communication Research Reports*, 28(3), 275–280.
<https://doi.org/10.1080/08824096.2011.587555>
- Martínez-Martí, M. L., & Ruch, W. (2016). Character strengths predict resilience over and above positive affect, self-efficacy, optimism, social support, self-esteem, and life satisfaction. *The Journal of Positive Psychology*, 1–10. <https://doi.org/10.1080/17439760.2016.1163403>
- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4), 370–396.
- Maslow, A. H. (1954). *Motivation and Personality*. Harper & Row inc.
- Mayring, P. (2000). Qualitative Content Analysis. *Forum: Qualitative Social Research*, 1(2). <http://www.qualitative-research.net/index.php/fqs/article/view/1089>
- McGrath, R. E. (2015). Integrating psychological and cultural perspectives on virtue: The hierarchical structure of character strengths. *The Journal of Positive Psychology*, 10(5), 407–424.
<https://doi.org/10.1080/17439760.2014.994222>
- McGrath, R. E. (2017). *The VIA Assessment Suite for Adults: Development and Initial Evaluation*. VIA Institute on Character Strengths.
- Meyer, M. L., Salimpoor, V. N., Wu, S. S., Geary, D. C., & Menon, V. (2010). Differential contribution of specific working memory components to mathematics achievement in 2nd and 3rd graders. *Learning and Individual Differences*, 20(2), 101–109.
<https://doi.org/10.1016/j.lindif.2009.08.004>
- Miller, A. (2008). A critique of positive psychology—Or ‘the new science of happiness’. *Journal of Philosophy of Education*, 42(3–4), 591–608.
<https://doi.org/10.1111/j.1467-9752.2008.00646.x>
- Miyake, A., & Friedman, N. P. (2012). The Nature and Organization of Individual Differences in Executive Functions: Four General Conclusions. *Current Directions in Psychological Science*, 21(1), 8–14.
<https://doi.org/10.1177/0963721411429458>

- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The Unity and Diversity of Executive Functions and Their Contributions to Complex “Frontal Lobe” Tasks: A Latent Variable Analysis. *Cognitive Psychology*, 41(1), 49–100.
<https://doi.org/10.1006/cogp.1999.0734>
- Monchi, O., Petrides, M., Petre, V., Worsley, K., & Dagher, A. (2001). Wisconsin Card Sorting Revisited: Distinct Neural Circuits Participating in Different Stages of the Task Identified by Event-Related Functional Magnetic Resonance Imaging. *The Journal of Neuroscience*, 21(19), 7733–7741.
<https://doi.org/10.1523/JNEUROSCI.21-19-07733.2001>
- Monsell, S. (2003). Task switching. *Trends in Cognitive Sciences*, 7(3), 134–140.
[https://doi.org/10.1016/S1364-6613\(03\)00028-7](https://doi.org/10.1016/S1364-6613(03)00028-7)
- Moore, A., & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Consciousness and Cognition*, 18(1), 176–186.
<https://doi.org/10.1016/j.concog.2008.12.008>
- Morgan, D. L. (2007). Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods. *Journal of Mixed Methods Research*, 1(1), 48–76.
<https://doi.org/10.1177/2345678906292462>
- Morisano, D., Hirsh, J. B., Peterson, J. B., Pihl, R. O., & Shore, B. M. (2010). Setting, elaborating, and reflecting on personal goals improves academic performance. *Journal of Applied Psychology*, 95(2), 255–264.
<https://doi.org/10.1037/a0018478>
- Moseholm, E., & Fetters, M. D. (2017). Conceptual models to guide integration during analysis in convergent mixed methods studies. *Methodological Innovations*, 10(2), 1–11. <https://doi.org/10.1177/2059799117703118>
- Mounton, A. R., & Montijo, M. N. (2018). Hope and Work. In M. W. Gallagher & S. J. Lopez (Eds.), *The Oxford Handbook of Hope* (pp. 327–340). Oxford University Press.
- Muyan-Yilik, M., & Demir, A. (2019). A Pathway Towards Subjective Well-Being for Turkish University Students: The Roles of Dispositional Hope,

- Cognitive Flexibility, and Coping Strategies. *Journal of Happiness Studies*, 1–19. <https://doi.org/doi:10.1007/s10902-019-00162-2>
- Nakamura, J., & Csikszentmihalyi, M. (2009). Flow Theory and Research. In C. R. Snyder & S. J. Lopez (Eds.), *Oxford handbook of positive psychology* (pp. 195–206). Oxford University Press.
- Navon, D. (1977). Forest before trees: The precedence of global features in visual perception. *Cognitive Psychology*, 9(3), 353–383. [https://doi.org/10.1016/0010-0285\(77\)90012-3](https://doi.org/10.1016/0010-0285(77)90012-3)
- Navon, D. (1981). The forest revisited: More on global precedence. *Psychological Research*, 43(1), 1–32.
- Nichols, A. L., & Maner, J. K. (2008). The Good-Subject Effect: Investigating Participant Demand Characteristics. *The Journal of General Psychology*, 135(2), 151–166. <https://doi.org/10.3200/GENP.135.2.151-166>
- Niemiec, R. M. (2013). VIA Character Strengths: Research and Practice (The First 10 Years). In H. Knoop & A. Delle Fave (Eds.), *Well-Being and Cultures. Cross-Cultural Advancements in Positive Psychology* (Vol. 3, pp. 11–29). Springer Science + Business Media.
- Nollen, N., Befort, C., Pulvers, K., James, A. S., Kaur, H., Mayo, M. S., Hou, Q., & Ahluwalia, J. S. (2008). Demographic and psychosocial factors associated with increased fruit and vegetable consumption among smokers in public housing enrolled in a randomized trial. *Health Psychology*, 27(3), 252–259. [https://doi.org/10.1037/0278-6133.27.3\(Suppl.\).S252](https://doi.org/10.1037/0278-6133.27.3(Suppl.).S252)
- Nothwehr, F., Clark, D. O., & Perkins, A. (2013). Hope and the use of behavioural strategies related to diet and physical activity. *Journal of Human Nutrition and Dietetics*, 26(1), 159–163. <https://doi.org/10.1111/jhn.12057>
- Nyhus, E., & Barceló, F. (2009). The Wisconsin Card Sorting Test and the cognitive assessment of prefrontal executive functions: A critical update. *Brain and Cognition*, 71(3), 437–451. <https://doi.org/10.1016/j.bandc.2009.03.005>
- Oltețeanu, A.-M., & Falomir, Z. (2016). Object replacement and object composition in a creative cognitive system. Towards a computational solver of the Alternative Uses Test. *Cognitive Systems Research*, 39, 15–32. <https://doi.org/10.1016/j.cogsys.2015.12.011>

- O'Reilly, R. C. (2013). Individual Differences in Cognitive Flexibility. *Biological Psychiatry*, 74(2), 78–79. <https://doi.org/10.1016/j.biopsych.2013.05.012>
- Orne, M. T. (1962). on the social psychology of the psychological experiment: With particular reference to demand characteristics and their implications. *American Psychologist*, 17, 776–783.
- Östlund, U., Kidd, L., Wengström, Y., & Rowa-Dewar, N. (2011). Combining qualitative and quantitative research within mixed method research designs: A methodological review. *International Journal of Nursing Studies*, 48(3), 369–383. <https://doi.org/10.1016/j.ijnurstu.2010.10.005>
- Ouweneel, E., Le Blanc, P. M., Schaufeli, W. B., & van Wijhe, C. I. (2012). Good morning, good day: A diary study on positive emotions, hope, and work engagement. *Human Relations*, 65(9), 1129–1154. <https://doi.org/10.1177/0018726711429382>
- Park, N., Peterson, C., & Seligman, M. E. P. (2004). Strengths of character and well-being. *Journal of Social and Clinical Psychology*, 23(5), 603–619. <https://doi.org/10.1521/jscp.23.5.603.50748>
- Pedrotti, J. T. (2017). *The Will and the Ways in School* (M. W. Gallagher & S. J. Lopez, Eds.; Vol. 1). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780199399314.013.9>
- Pedrotti, J. T., Edwards, L., & Lopez, S. J. (2008). Promoting Hope: Suggestions for School Counselors. *Professional School Counseling*, 12(2), 100–107.
- Pereg, M., Shahar, N., & Meiran, N. (2013). Task switching training effects are mediated by working-memory management. *Intelligence*, 41(5), 467–478. <https://doi.org/10.1016/j.intell.2013.06.009>
- Peterson, C., & Park, N. (2009). Classifying and Measuring Strengths of character. In C. R. Snyder & S. J. Lopez (Eds.), *Oxford handbook of positive psychology* (pp. 25–34). Oxford University Press.
- Peterson, C., & Seligman, M. E. P. (2004). *Character strengths and virtues: A handbook and classification*. Oxford University Press.
- Peterson, C., Semmel, A., Von Baeyer, C., Abramson, L. Y., Metalsky, G. I., & Seligman, M. E. P. (1982). The attributional style questionnaire. *Cognitive Therapy and Research*, 6(3), 287–299.

- Phillips, L. H., Bull, R., Adams, E., & Fraser, L. (2002). Positive mood and executive function: Evidence from Stroop and fluency tasks. *Emotion, 2*(1), 12–22.
<https://doi.org/10.1037//1528-3542.2.1.12>
- Powell, H., Mihalas, S., Onwuegbuzie, A. J., Suldo, S., & Daley, C. E. (2008). Mixed methods research in school psychology: A mixed methods investigation of trends in the literature. *Psychology in the Schools, 45*(4), 291–309.
<https://doi.org/10.1002/pits.20296>
- Proctor, C. (2017). *Positive psychology interventions in practice*. Springer Berlin Heidelberg.
- Proctor, C., Tsukayama, E., Wood, A. M., Maltby, J., Eades, J. F., & Linley, P. A. (2011). Strengths Gym: The impact of a character strengths-based intervention on the life satisfaction and well-being of adolescents. *The Journal of Positive Psychology, 6*(5), 377–388.
<https://doi.org/10.1080/17439760.2011.594079>
- QSR International Pty Ltd. (2015). *NVivo* (Version 12).
- Rand, K. L., & Cheavens, J. (2009). Hope Theory. In S. J. Lopez & C. R. Snyder (Eds.), *Oxford handbook of positive psychology* (pp. 323–334). Oxford University Press.
- Rasmussen, H. N., Koetting O’Byrne, K., Vandament, M., & Cole, B. P. (2018). *Hope and Physical Pain*.
- Reichard, R. J., Avey, J. B., Lopez, S., & Dollwet, M. (2013). Having the will and finding the way: A review and meta-analysis of hope at work. *The Journal of Positive Psychology, 8*(4), 292–304.
<https://doi.org/10.1080/17439760.2013.800903>
- Resnick, S. G., & Rosenheck, R. A. (2006). Recovery and Positive Psychology: Parallel Themes and Potential Synergies. *Psychiatric Services, 57*(1), 120–122. <https://doi.org/10.1176/appi.ps.57.1.120>
- Ritter, R. S., & Preston, J. L. (2011). Gross gods and icky atheism: Disgust responses to rejected religious beliefs. *Journal of Experimental Social Psychology, 47*(6), 1225–1230.
<https://doi.org/10.1016/j.jesp.2011.05.006>

- Ritter, S. M., & Ferguson, S. (2017). Happy creativity: Listening to happy music facilitates divergent thinking. *PLOS ONE*, 12(9), 1–14.
<https://doi.org/10.1371/journal.pone.0182210>
- Ritter, S. M., & Mostert, N. (2017). Enhancement of Creative Thinking Skills Using a Cognitive-Based Creativity Training. *Journal of Cognitive Enhancement*, 1(3), 243–253. <https://doi.org/10.1007/s41465-016-0002-3>
- Robbins, B. D. (2008). What is the good life? Positive psychology and the renaissance of humanistic psychology. *The Humanistic Psychologist*, 36(2), 96–112. <https://doi.org/10.1080/08873260802110988>
- Robbins, T. W., Anderson, E. J., Barker, D. R., Bradley, A. C., Fearnlyhough, C., Henson, R., Hudson, S. R., & Baddeley, A. D. (1996). Working memory in chess. *Memory & Cognition*, 24(1), 83–93.
<https://doi.org/10.3758/BF03197274>
- Roca, M., Parr, A., Thompson, R., Woolgar, A., Torralva, T., Antoun, N., Manes, F., & Duncan, J. (2010). Executive function and fluid intelligence after frontal lobe lesions. *Brain*, 133(1), 234–247.
<https://doi.org/10.1093/brain/awp269>
- Rogers, R. D., & Monsell, S. (1995). Costs of a predictable switch between simple cognitive tasks. *Journal of Experimental Psychology: General*, 124(2), 207–231. <https://doi.org/10.1037/0096-3445.124.2.207>
- Rose, S., & Sieben, N. (2018). Hope Measurement. In M. W. Gallagher & S. J. Lopez (Eds.), *The Oxford Handbook of Hope* (pp. 83–94). Oxford University Press.
- Ruch, W., Niemiec, R. M., McGrath, R. E., Gander, F., & Proyer, R. T. (2020). Character strengths-based interventions: Open questions and ideas for future research. *The Journal of Positive Psychology*.
<https://doi.org/10.1080/17439760.2020.1789700>
- Rueda, M. R., Checa, P., & Cómbita, L. M. (2012). Enhanced efficiency of the executive attention network after training in preschool children: Immediate changes and effects after two months. *Developmental Cognitive Neuroscience*, 2, 192–204.
<https://doi.org/10.1016/j.dcn.2011.09.004>

- Runco, M. A., & Acar, S. (2012). Divergent Thinking as an Indicator of Creative Potential. *Creativity Research Journal*, 24(1), 66–75.
<https://doi.org/10.1080/10400419.2012.652929>
- Ryff, C. D., & Singer, B. H. (2008). Know Thyself and Become What You Are: A Eudaimonic Approach to Psychological Well-Being. *Journal of Happiness Studies*, 9(1), 13–39. <https://doi.org/10.1007/s10902-006-9019-0>
- Salanova, M., Bakker, A. B., & Llorens, S. (2006). Flow at Work: Evidence for an Upward Spiral of Personal and Organizational Resources. *Journal of Happiness Studies*, 7(1), 1–22. <https://doi.org/10.1007/s10902-005-8854-8>
- Samanez-Larkin, G. R., Buckholtz, J. W., Cowan, R. L., Woodward, N. D., Li, R., Ansari, M. S., Arrington, C. M., Baldwin, R. M., Smith, C. E., Treadway, M. T., Kessler, R. M., & Zald, D. H. (2013). A Thalamocorticostriatal Dopamine Network for Psychostimulant-Enhanced Human Cognitive Flexibility. *Biological Psychiatry*, 74(2), 99–105.
<https://doi.org/10.1016/j.biopsych.2012.10.032>
- Sánchez-Cubillo, I., Periañez, J. A., Adrover-Roig, D., Rodríguez-Sánchez, J. M., Ríos-Lago, M., Tirapu, J., & Barceló, F. (2009). Construct validity of the Trail Making Test: Role of task-switching, working memory, inhibition/interference control, and visuomotor abilities. *Journal of the International Neuropsychological Society*, 15(03), 438–450.
<https://doi.org/10.1017/S1355617709090626>
- Sanders, A. F., & Lamers, J. M. (2002). The Eriksen Flanker effect revisited. *Acta Psychologica*, 109, 41–56.
- Scholz, U., Gutiérrez Doña, B., Sud, S., & Schwarzer, R. (2002). Is General Self-Efficacy a Universal Construct?1. *European Journal of Psychological Assessment*, 18(3), 242–251. <https://doi.org/10.1027//1015-5759.18.3.242>
- Schweickle, M., Groves, S., Vella, S. A., & Swann, C. (2017). The effects of open vs. Specific goals on flow and clutch states in a cognitive task. *Psychology of Sport and Exercise*, 33, 45–54.
<https://doi.org/10.1016/j.psychsport.2017.08.002>

- Scollon, C. N., Kim-Prieto, C., & Scollon, C. N. (2003). Experience Sampling: Promises and Pitfalls, Strengths and Weaknesses. *Journal of Happiness Studies*, 4(1), 5–34. <https://doi.org/10.1023/A:1023605205115>
- Scott, W. A. (1962). Cognitive Complexity and Cognitive Flexibility. *Sociometry*, 25(4), 405–414. <https://doi.org/10.2307/2785779>
- Seligman, M. E. P. (2003). Fundamental assumptions. *Psychologist*, 16(3), 126.
- Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist*, 55(1), 5–14. <https://doi.org/10.1037//0003-066X.55.1.5>
- Seligman, M. E. P., Ernst, R. M., Gillham, J., Reivich, K., & Linkins, M. (2009). Positive education: Positive psychology and classroom interventions. *Oxford Review of Education*, 35(3), 293–311. <https://doi.org/10.1080/03054980902934563>
- Seligman, M. E. P., Steen, T. A., Park, N., & Peterson, C. (2005). Positive Psychology Progress: Empirical Validation of Interventions. *American Psychologist*, 60(5), 410–421. <https://doi.org/10.1037/0003-066X.60.5.410>
- Selvam, S. G., & Poulson, M. (2012). The Psychology of Hope from the Perspective of Religion. *Journal of Dharma*, 37(4), 393–410.
- Sethi, S., & Seligman, M. E. P. (1993). Optimism and Fundamentalism. *Psychological Science*, 4(4), 256–259. <https://doi.org/10.1111/j.1467-9280.1993.tb00271.x>
- Sheldon, K. M., & King, L. (2001). Why Positive Psychology Is Necessary. *American Psychologist*, 56(3), 216–217.
- Singh, A. K., Singh, S., & Singh, A. P. (2012). Does Trait Predict Psychological Well-Being among Students of Professional Courses. 38(2), 234–241. <https://doi.org/10.13140/2.1.3964.9925>
- Snyder, C. R., Berg, C. J., Woodward, J. T., Gum, A., Rand, K. L., Wroblewski, K. K., Brown, J., & Hackman, A. (2005). Hope Against the Cold: Individual Differences in Trait Hope and Acute Pain Tolerance on the Cold Pressor Task. *Journal of Personality*, 73(2), 287–312. <https://doi.org/10.1111/j.1467-6494.2005.00318.x>

- Snyder, C. R., Feldman, D. B., Taylor, J. D., Schroeder, L. L., & Adams, V. H. (2000). The roles of hopeful thinking in preventing problems and enhancing strengths. *Applied and Preventive Psychology, 9*(4), 249–269.
[https://doi.org/10.1016/S0962-1849\(00\)80003-7](https://doi.org/10.1016/S0962-1849(00)80003-7)
- Snyder, C. R., Harris, C., Anderson, J. R., Holleran, S. A., Irving, L. M., Sigmon, S. T., Yoshinobu, L., Gibb, J., Langelle, C., & Harney, P. (1991). The will and the ways: Development and validation of an individual-differences measure of hope. *Journal of Personality and Social Psychology, 60*(4), 570–585.
<https://doi.org/10.1037/0022-3514.60.4.570>
- Snyder, C. R., Hoza, B., Pelham, W. E., Rapoff, M., Ware, L., Danovsky, M., Highberger, L., Ribinstein, H., & Stahl, K. J. (1997). The Development and Validation of the Children's Hope Scale. *Journal of Pediatric Psychology, 22*(3), 399–421. <https://doi.org/10.1093/jpepsy/22.3.399>
- Snyder, C. R., Lopez, S. J., Shorey, H. S., Rand, K. L., & Feldman, D. B. (2003). Hope theory, measurements, and applications to school psychology. *School Psychology Quarterly, 18*(2), 122–139.
<https://doi.org/10.1521/scpq.18.2.122.21854>
- Snyder, C. R., Shorey, H. S., Cheavens, J., Pulvers, K. M., Adams, V. H., III, & Wiklund, C. (2002). Hope and academic success in college. *Journal of Educational Psychology, 94*(4), 820–826. <https://doi.org/10.1037/0022-0663.94.4.820>
- Snyder, C. R., Simpson, S. C., Ybasco, F. C., Borders, T. F., Babyak, M. A., & Higgins, R. L. (1996). Development and validation of the State Hope Scale. *Journal of Personality and Social Psychology, 70*(2), 321–335.
<https://doi.org/10.1037/0022-3514.70.2.321>
- Steverink, N., Lindenberg, S., & Slaets, J. P. J. (2005). How to understand and improve older people's self-management of wellbeing. *European Journal of Ageing, 2*(4), 235–244. <https://doi.org/10.1007/s10433-005-0012-y>
- Strobach, T., Frensch, P. A., & Schubert, T. (2012). Video game practice optimizes executive control skills in dual-task and task switching situations. *Acta Psychologica, 140*(1), 13–24.
<https://doi.org/10.1016/j.actpsy.2012.02.001>

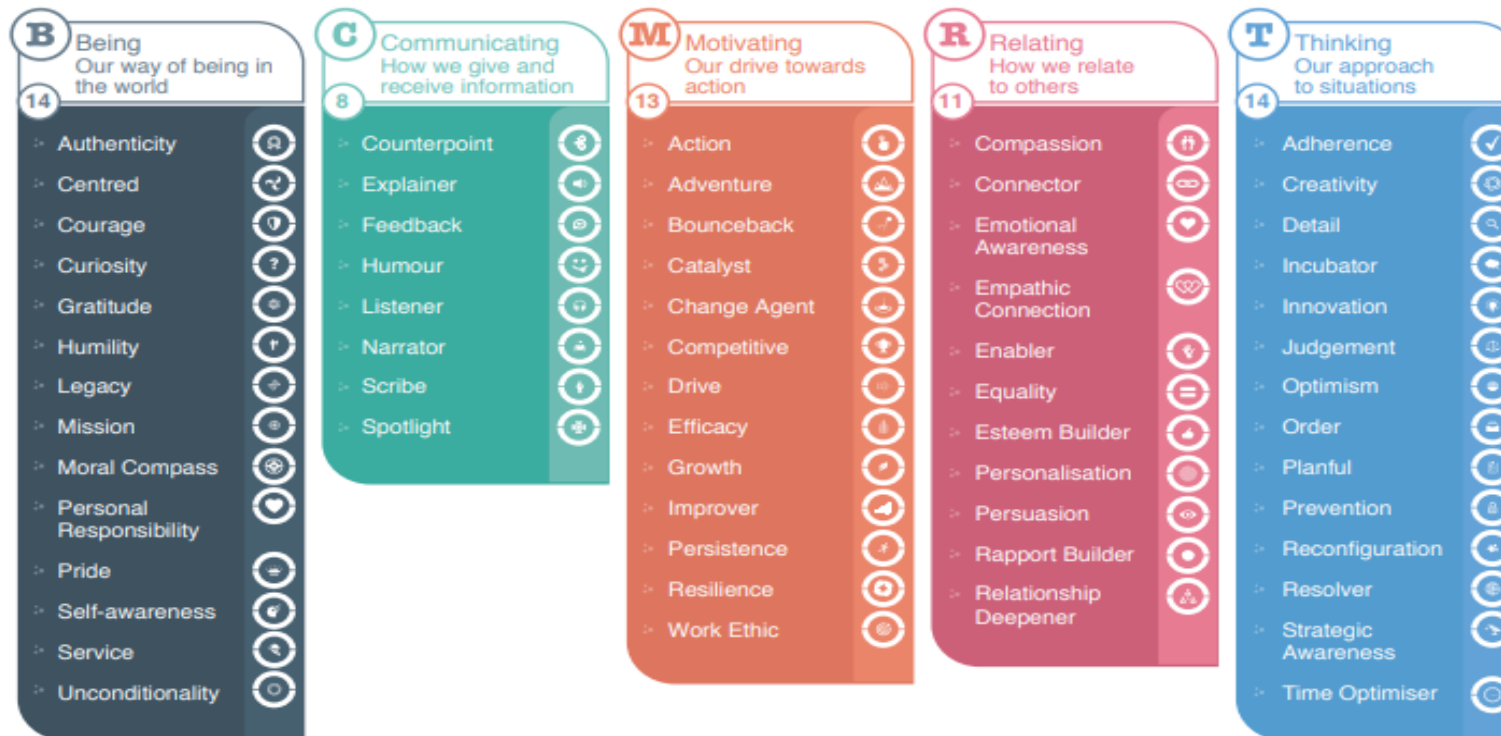
- Stroop, J. R. (1935). Studies of Interference in Serial Verbal Reactions. *Journal of Experimental Psychology*, 18(6), 643–663.
- Theeuwes, J. (2010). Top–down and bottom–up control of visual selection. *Acta Psychologica*, 135(2), 77–99.
<https://doi.org/10.1016/j.actpsy.2010.02.006>
- Tiger, L. (1979). *Optimism: The Biology of hope*. Simon & Schuster.
- Tong, E. M. W., Fredrickson, B. L., Chang, W., & Lim, Z. X. (2010). Re-examining hope: The roles of agency thinking and pathways thinking. *Cognition & Emotion*, 24(7), 1207–1215.
<https://doi.org/10.1080/02699930903138865>
- Tugade, M. M., & Fredrickson, B. L. (2004). Resilient Individuals Use Positive Emotions to Bounce Back From Negative Emotional Experiences. *Journal of Personality and Social Psychology*, 86(2), 320–333.
<https://doi.org/10.1037/0022-3514.86.2.320>
- Ueda, Y., Tominaga, A., Kajimura, S., & Nomura, M. (2016). Spontaneous eye blinks during creative task correlate with divergent processing. *Psychological Research*, 80(4), 652–659. <https://doi.org/10.1007/s00426-015-0665-x>
- van de Schoot, R., Winter, S. D., Ryan, O., Zondervan-Zwijnenburg, M., & Depaoli, S. (2017). A systematic review of Bayesian articles in psychology: The last 25 years. *Psychological Methods*, 22(2), 217–239.
<https://doi.org/10.1037/met0000100>
- Vandierendonck, A., Kemps, E., Fastame, M. C., & Szmalec, A. (2004). Working memory components of the Corsi blocks task. *British Journal of Psychology*, 95(1), 57–79. <https://doi.org/10.1348/000712604322779460>
- Verbruggen, F., & Logan, G. D. (2008). Automatic and controlled response inhibition: Associative learning in the go/no-go and stop-signal paradigms. *Journal of Experimental Psychology: General*, 137(4), 649–672. <https://doi.org/10.1037/a0013170>
- Vincent, A. S., Decker, B. P., & Mumford, M. D. (2002). Divergent Thinking, Intelligence, and Expertise: A Test of Alternative Models. *Creativity*

- Research Journal*, 14(2), 163–178.
https://doi.org/10.1207/S15326934CRJ1402_4
- Walsh, R., & Shapiro, S. L. (2006). The meeting of meditative disciplines and western psychology: A mutually enriching dialogue. *American Psychologist*, 61(3), 227–239. <https://doi.org/10.1037/0003-066X.61.3.227>
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063–1070.
- Waugh, C. E., & Fredrickson, B. L. (2006). Nice to know you: Positive emotions, self–other overlap, and complex understanding in the formation of a new relationship. *The Journal of Positive Psychology*, 1(2), 93–106.
<https://doi.org/10.1080/17439760500510569>
- Weis, R., & Speridakos, E. C. (2011). A Meta-Analysis of hope enhancement strategies in clinical and community settings. *Psychology of Well-Being: Theory, Research and Practice*, 1(5), 1–16. <https://doi.org/10.1186/2211-1522-1-5>
- Williams, N., Horrell, L., Edmiston, D., & Brady, M. (2018). The Impact of Positive Psychology on Higher Education. *The William & Mary Educational Review*, 5(1), 83–94.
- Wolfe, J. M. (2010). Visual Search. *Current Biology*, 20(8), 346–349.
<https://doi.org/10.1016/j.cub.2010.02.016>
- Wroblewski, K. K., & Snyder, C. R. (2005). Hopeful Thinking in Older Adults: Back to the Future. *Experimental Aging Research*, 31(2), 217–233.
<https://doi.org/10.1080/03610730590915452>
- Yeager, D. S., Bundick, M. J., & Johnson, R. (2012). The role of future work goal motives in adolescent identity development: A longitudinal mixed-methods investigation. *Contemporary Educational Psychology*, 37(3), 206–217. <https://doi.org/10.1016/j.cedpsych.2012.01.004>
- You, J., Fung, H. H. L., & Isaacowitz, D. M. (2009). Age differences in dispositional optimism: A cross-cultural study. *European Journal of Ageing*, 6(4), 247–252. <https://doi.org/10.1007/s10433-009-0130-z>

- Youmans, R. J., Figueroa, I. J., & Kramarova, O. (2011). Reactive Task-Set Switching Ability, Not Working Memory Capacity, Predicts Change Blindness Sensitivity. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 55(1), 914–918.
<https://doi.org/10.1177/1071181311551190>
- Yu, J., & Lee, T. M. C. (2017). Cognitive flexibility and changes in hopelessness across time: A moderation hypothesis. *Applied Neuropsychology: Adult*, 24(5), 404–409. <https://doi.org/10.1080/23279095.2016.1155991>

Appendices

Appendix 1- R2 Strengths Dictionary, from R2 Strength Profiler (Capp & Co, 2015).



Appendix 2- The State Hope Scale (Snyder et al, 1994).

Read each item carefully. Using the scale shown below, please select the number that best describes *how you think about yourself right now* and put that number in the blank before each sentence. Please take a few moments to focus on yourself and what is going on in *your life at this moment*. Once you have this “here and now” set, go ahead and answer each item according to the following scale:

1	2	3	4	5	6	7	8
Definitely False	Mostly False	Somewhat False	Slightly False	Slightly True	Somewhat True	Mostly True	Definitely True

- _____ 1. If I should find myself in a jam, I could think of many ways to get out of it.
- _____ 2. At the present time, I am energetically pursuing my goals.
- _____ 3. There are lots of ways around any problem that I am facing now.
- _____ 4. Right now, I see myself as being pretty successful.
- _____ 5. I can think of many ways to reach my current goals.
- _____ 6. At this time, I am meeting the goals that I have set for myself.

Appendix 3- The Trait Hope Scale (Snyder et al, 1991).

Directions: Read each item carefully. Using the scale shown below, please select the number that best describes YOU and put that number in the blank provided.

- 1. = Definitely False
- 2. = Mostly False
- 3. = Somewhat False
- 4. = Slightly False
- 5. = Slightly True
- 6. = Somewhat True
- 7. = Mostly True
- 8. = Definitely True

- ___ 1. I can think of many ways to get out of a jam.
- ___ 2. I energetically pursue my goals.
- ___ 3. I feel tired most of the time.
- ___ 4. There are lots of ways around any problem.
- ___ 5. I am easily downed in an argument.
- ___ 6. I can think of many ways to get the things in life that are important to me.
- ___ 7. I worry about my health.
- ___ 8. Even when others get discouraged, I know I can find a way to solve the problem.
- ___ 9. My past experiences have prepared me well for my future.
- ___ 10. I've been pretty successful in life.
- ___ 11. I usually find myself worrying about something.
- ___ 12. I meet the goals that I set for myself.

Appendix 4- The Positive and Negative Affect Schedule (Watson et al, 1998).

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)**

1	2	3	4	5
Very Slightly or Not at all	A little	Moderately	Quite a bit	Extremely
_____ 1. Interested				_____ 11. Irritable
_____ 2. Distressed				_____ 12. Alert
_____ 3. Excited				_____ 13. Ashamed
_____ 4. Upset				_____ 14. Inspired
_____ 5. Strong				_____ 15. Nervous
_____ 6. Guilty				_____ 16. Determined
_____ 7. Scared				_____ 17. Attentive
_____ 8. Hostile				_____ 18. Jittery
_____ 9. Enthusiastic				_____ 19. Active
_____ 10. Proud				_____ 20. Afraid